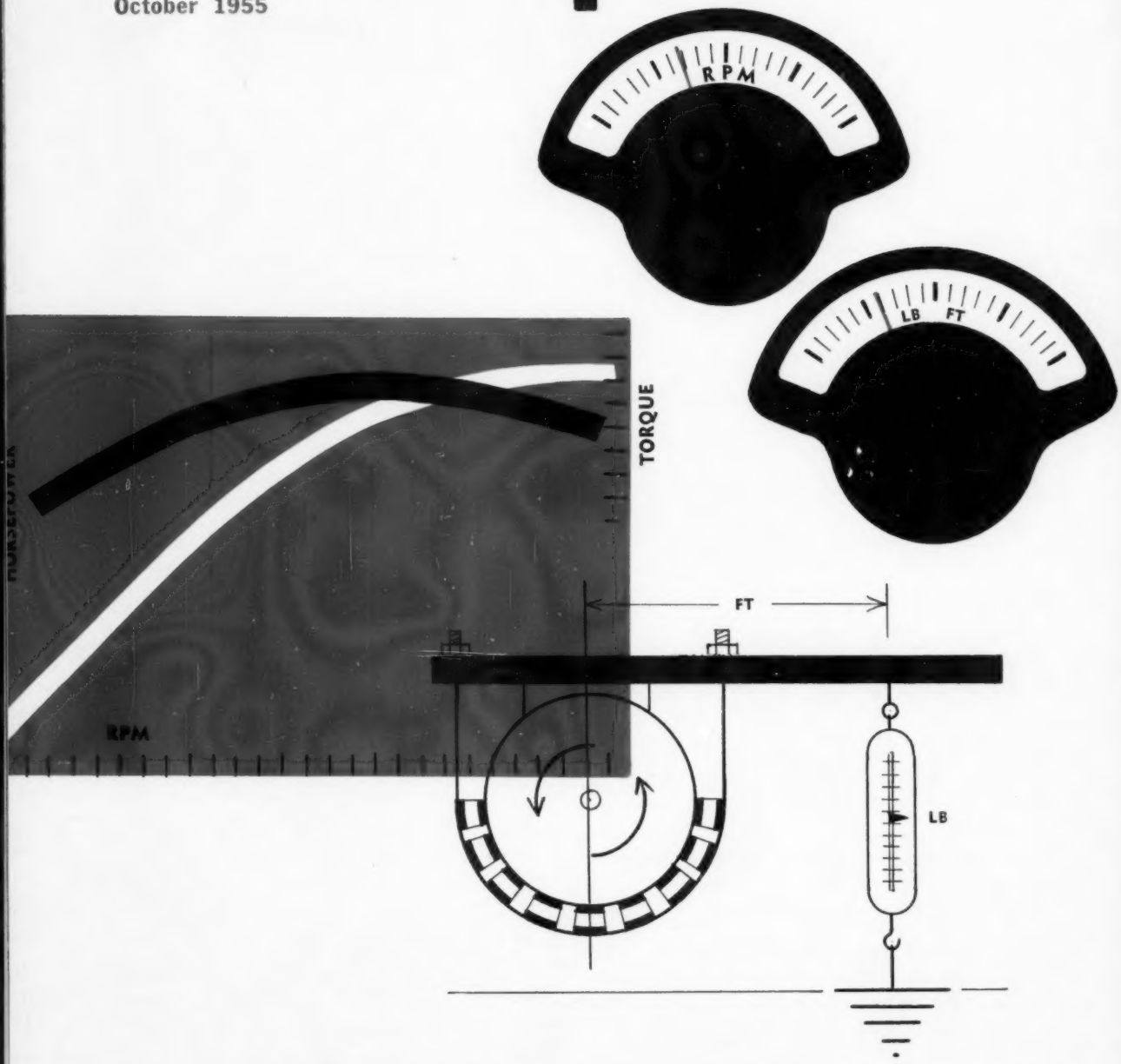
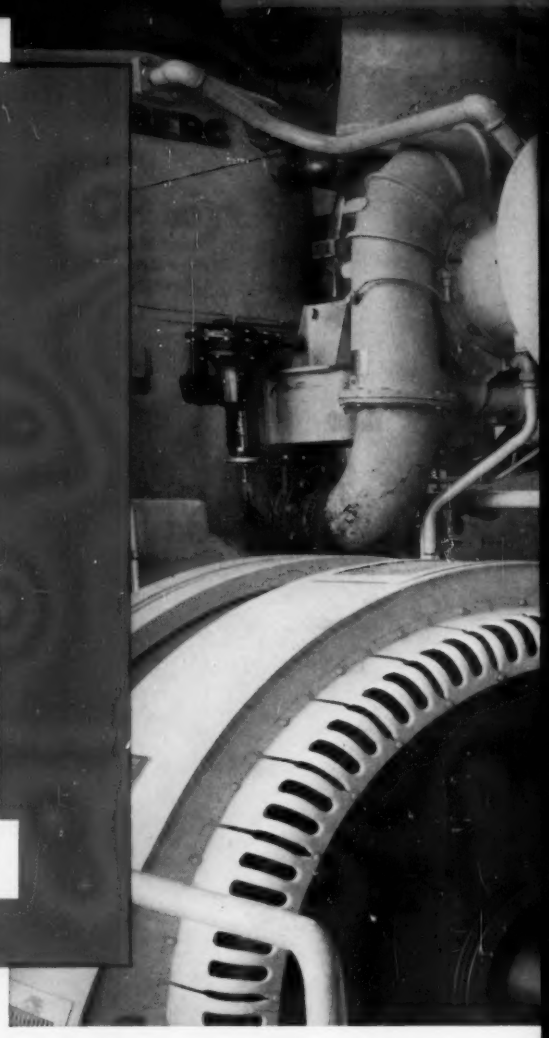
diesel power

October 1955



Power Proving and Run-In by Dynamometer

GOOD EXAMPLE OF HIGH EFFICIENCY DIESEL OPERATION



FEDERATED Rural Electric Association, Jackson, Minnesota, ranked first in efficiency in 1954 among REA non-base-loaded plants — and third among all plants in the REA system. This, according to Robert A. Staten, Chief Engineer, is due to exacting maintenance procedure plus the use of *Texaco Ursa Oil Heavy Duty* for engine lubrication. As Mr. Staten puts it:

> *"We keep a constantly watchful eye on our operating conditions and follow strict maintenance procedures. Texaco Ursa Oil Heavy Duty has done a wonderful job in backing us up. Overhauls unfailingly show engines clean — no deposits and all rings free. Wear is virtually unmeasurable. All this, of course, has helped us set our record for efficiency with low maintenance costs and minimum fuel consumption."*

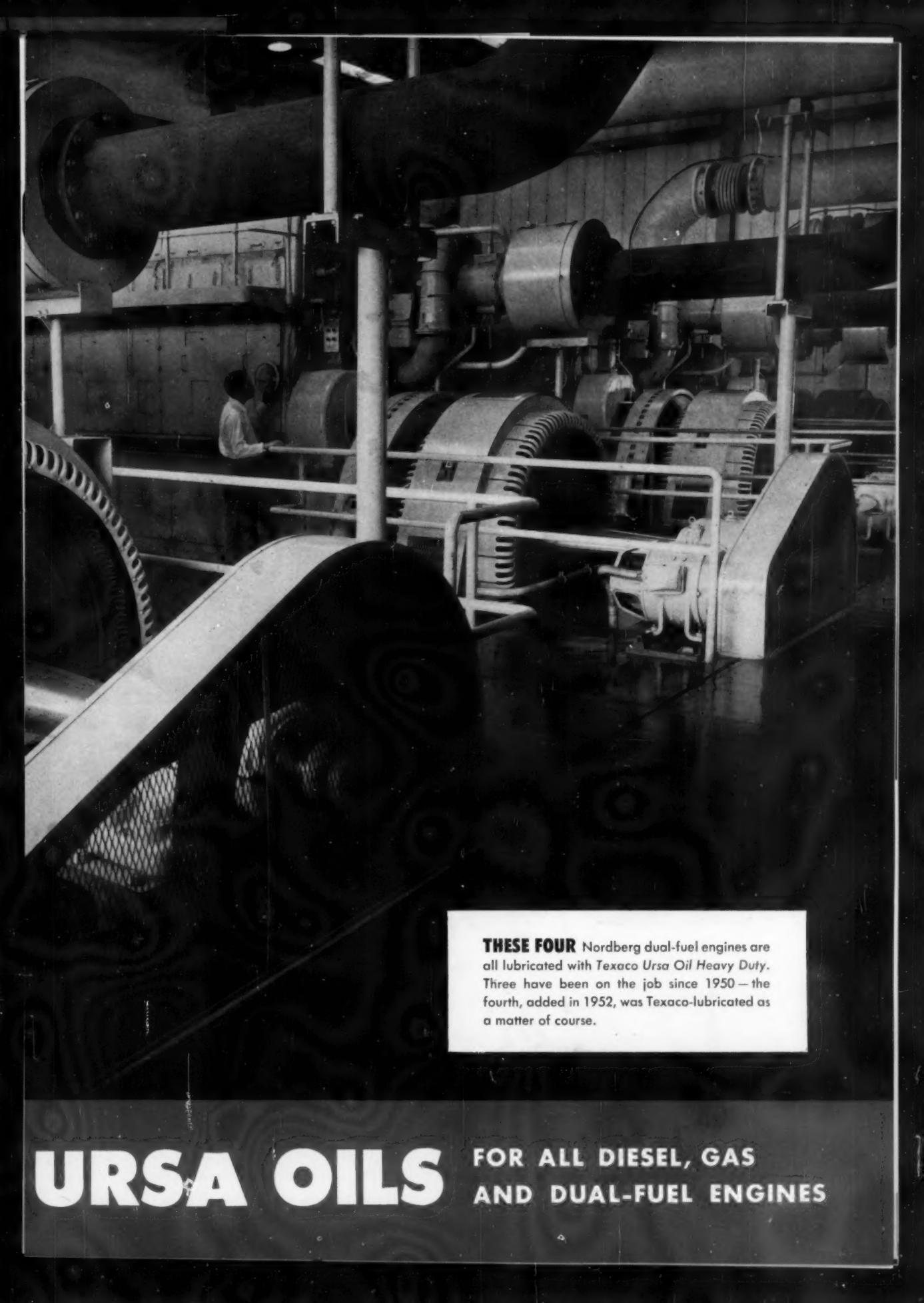
Texaco Ursa Oil Heavy Duty is one of the complete line of famous *Texaco Ursa Oils* especially refined and processed to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls. These benefits, consistently delivered, are the reasons why —

For over 20 years, more stationary diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer give you full details. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN . . .
TEXACO STAR THEATER
starring
JIMMY DURANTE
on television . . .
Saturday nights, NBC.

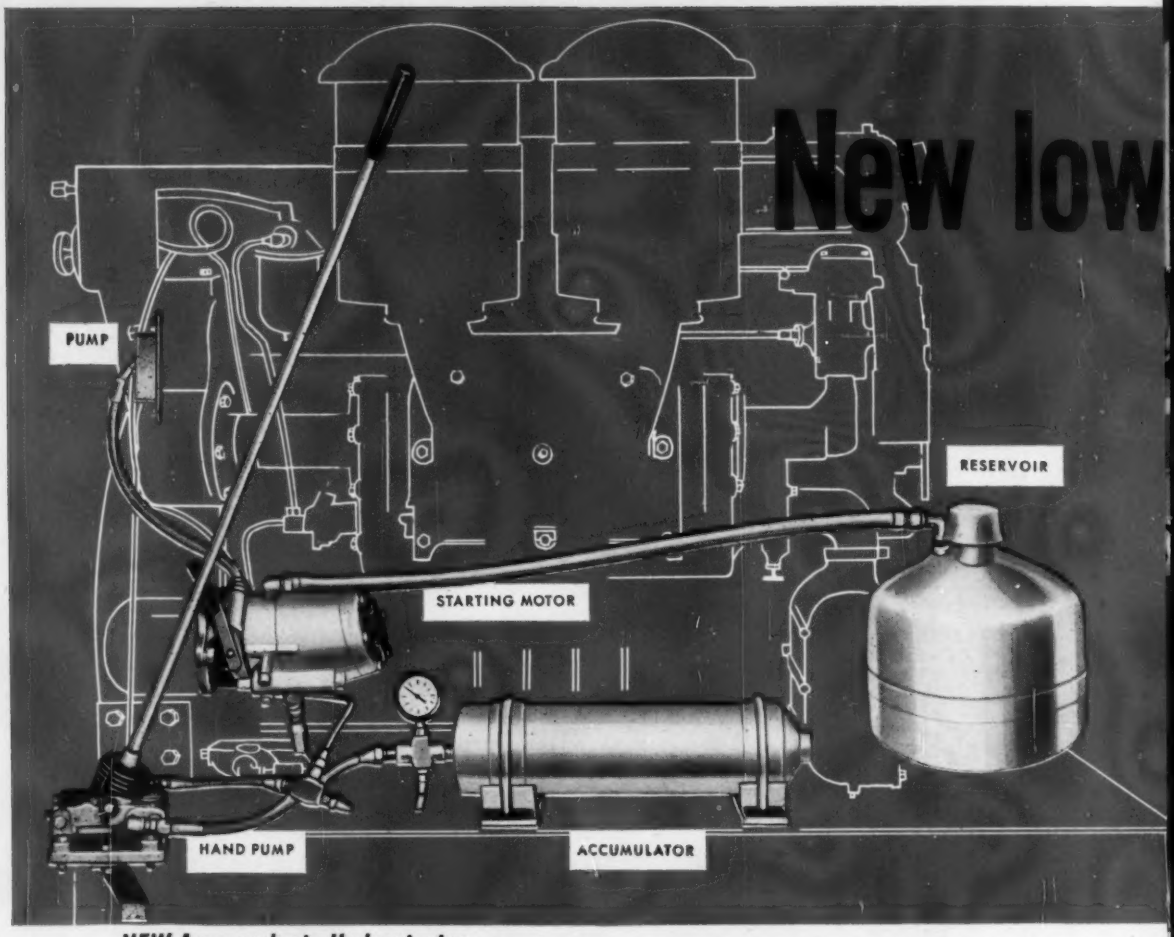
TEXACO



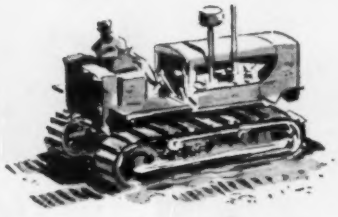
THESE FOUR Nordberg dual-fuel engines are all lubricated with *Texaco Ursa Oil Heavy Duty*. Three have been on the job since 1950 — the fourth, added in 1952, was Texaco-lubricated as a matter of course.

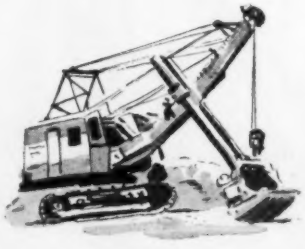
URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES



NEW Aeroproducts Hydrostarter **brings quick, sure, safe starting to Diesel engines in all kinds of weather. It frees Diesel operators from battery replacements, costs less than any other nonelectric Diesel starting system.**





General Motors engineering leads the way

cost Diesel Hydrostarter

For positive all-weather starting

Now you can start your Diesel engine quickly in any kind of weather with the new Aeroproducts Hydrostarter – the hydraulic starting system that replaces regular starters.

It spins a Diesel twice as fast as battery-operated starters, has no parts or components that require regular replacement, costs less to operate than electric starting systems.

It fits any Diesel engine up to 300 horsepower, lasts the life of the engine on which it is installed.

And it sells for a far lower price than any other nonelectric Diesel starter available today.

Easy to install—simple to maintain

Your Diesel engine dealer or equipment distributor can quickly install the Aeroproducts Hydrostarter on your Diesel. The system is so simple that his mechanics—or yours—can do the job with no special training. And all it takes is a few hours' time for installation.

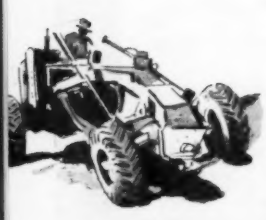
With a Hydrostarter on your Diesel your maintenance costs will drop, too. It's completely self-contained—routine maintenance checks are all the care it needs.

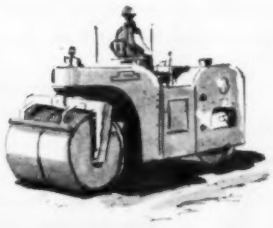
How the Hydrostarter works

Heart of the system is a hydraulic starting motor operated by high-pressure fluid. Pressure is built up and maintained by an engine-driven pump in a piston-type accumulator.

A simple control lever admits this high-pressure fluid to the starting motor, spinning the engine. This control lever also completely engages the starting motor's gears with the Diesel's flywheel before operation.

The hand-operated pump is provided to turn over the Diesel slowly for mechanical adjustments. It also is available to raise pressure if needed. The working fluid is stored and filtered in a reservoir.





See your dealer or write today

If you want quick, sure starts for your Diesels, ask your engine or equipment dealer about the new Aeroproducts Hydrostarter. He can give you full information—or quickly get it for you. If you prefer, fill in the coupon or write direct for more information.

GM GENERAL MOTORS

Building for today...Designing for tomorrow

Aeroproducts

ALLISON DIVISION OF GENERAL MOTORS
DAYTON, OHIO

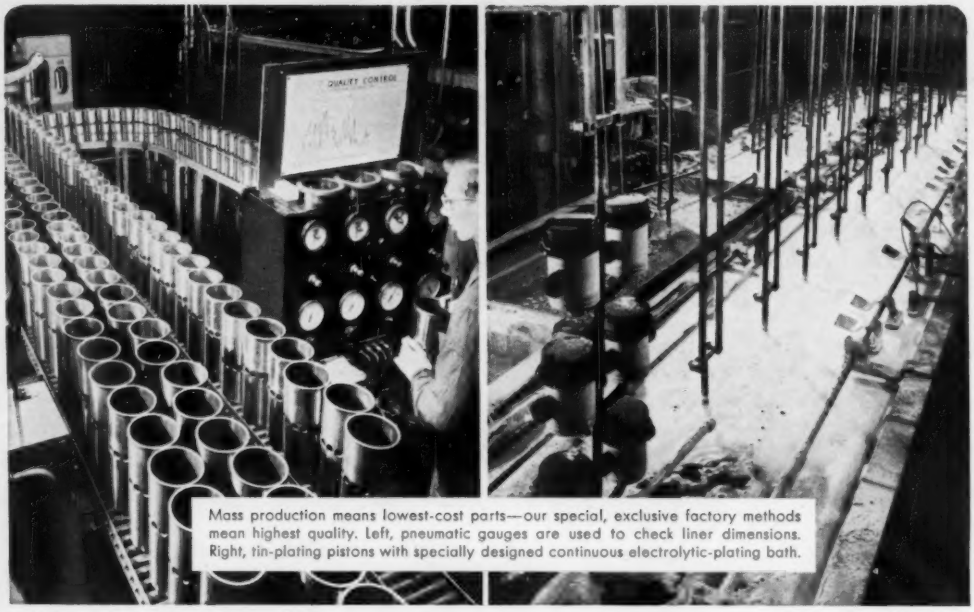
Please send me full information on the new Hydrostarter.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____



Mass production means lowest-cost parts—our special, exclusive factory methods mean highest quality. Left, pneumatic gauges are used to check liner dimensions. Right, tin-plating pistons with specially designed continuous electrolytic-plating bath.

IT PAYS TO BUY FACTORY-ENGINEERED

GM DIESEL PARTS

You put yourself dollars ahead and leave breakdowns behind when you buy genuine General Motors Diesel parts.

First, you pay less because mass production enables us to manufacture parts at lower cost.

Second, you get highest quality—quality that comes from continuous research and constant improvements by GM engineers—quality assured by precision manufacturing methods, checked by the most rigid tests at every stage of production.

Third, you get latest improvements because *only* General Motors Diesel parts and components have *all* the improvements originated by our engineers at the factory.

Fourth, you get longer-wearing parts—parts proved in billions of hours of service on the toughest jobs.

Next time you need replacement parts for your GM Diesel, get genuine factory-engineered parts. You'll keep your Diesel running right—*get more work at less cost on every job.*

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 30-300 H.P. Multiple Units . . . Up to 893 H.P.

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editors notes...

You'll want to read about...

Ways to get greater life from your engine valves. There are always reasons for premature failures and you must find and correct the real trouble unless you happen to like spending money for valve replacement and repair . . . .

The other guy's shop. How does he do things? What ideas can you adapt to your benefit? Maybe you'll say, "Hell, I've got a better shop!" And then we'll be doing one about you . . . .

Setting Cummins valve lash with a dial indicator. The Valve Gapper line now includes a rig for setting Cummins valve right on the button. And if you don't think lash is important, read the first article in this issue . . . .

Another "first", this time the first in a series of articles aimed at answering the questions arising from last month's survey of lube oil and filter change practices. This series can be important to you; follow it . . . .

How to run-in and power-prove a rebuilt engine with a dynamometer. Do you know the dangers of run-in without load, or of too early application of high load? When rating engines, how do you correct for temperature? altitude? Here are ways to get full benefit from your rebuilding . . . .

A lathe-mounted attachment that superfinishes crankshafts in a one-step operation. You get better dimensional accuracy while cutting the time you used before in lapping and polishing operations . . . .

diesel power

Established in 1923 Vol. 33, No. 10 October, 1955

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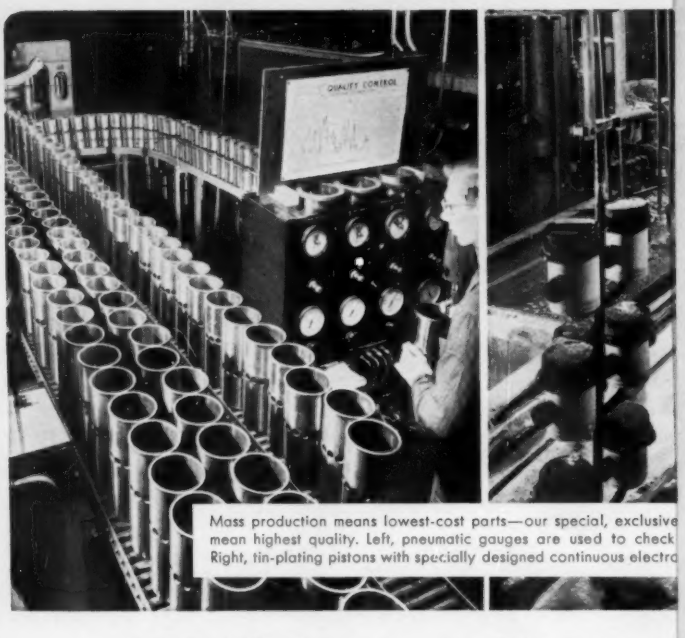

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You put yourself dollars ahead and leave breakdowns behind when you buy genuine General Motors Diesel parts.

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PARTS and SERVICE

You'll want to read about...

Power plant problems and some ways to lick them. Perhaps you'll find your particular headache among those listed, and if so, you'll be interested in the suggested cures. You may even find problems that you didn't even know you had. Using the article as a check list, you are bound to find some areas for improvement in your plant operation . . . .

How to cut time and costs in railroad repairs by special tools and devices. Most originate in the shop where the work is done. Then some prove so practical that they are built commercially. Here are some of the time-saving devices currently being used . . . .

How compression pressure affects engine efficiency. You'll need the right rings to seal under the particular liner and piston conditions. How do you pick rings? If you know all the answers, read the article and check up on us; if you don't, it will help you . . . .

Air or mud for deep oil-well drilling? Here's a diesel-driven compressor set for use when air is used to clear cuttings and cool bits . . . .

With all the emphasis on tools and maintenance in this issue, we dropped the "Straight from the Tool Box" feature for this month. Two reasons—lack of space and good meaty items are getting short. How about it?

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M. D. Pugh—Pacific Coast Mgr.
2721 N. Marengo Ave.
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Tom Clifford
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Tel. ES 8-1939

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SOLVE vibration • movement • expansion problems

SIMPLIFY offset connections

REDUCE maintenance ...in diesel exhaust, air, oil and water piping

In diesel engine piping systems, American flexible metal hose offers a practical solution to problems of vibration and expansion, the principal reasons for accelerated failure of rigid pipe. It's simpler to install, too. You *bend* it into position, saving time on the job and making easy work of fitting offset connections.

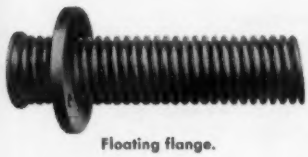
For heavy-duty exhaust and air intake lines, specify American Flexible Steel Corrugated Hose. It adjusts to expansion and dampens engine vibration, preventing excessive stress on exhaust manifold flange bolts and fittings. Vibration dissipates in the hose and is not transmitted to adjacent structural members. Assemblies are supplied complete with floating flanges to simplify lining up with companion flanges.

To convey air, oil and water, use American Seamless Flexible Metal Tubing. Made in bronze or carbon steel for standard service, and in stainless steel or Monel for special service. Tubing has woven wire braid covering for added strength. Complete assemblies include fittings.

55199

Type Y-10 flexible, corrugated exhaust hose assembly with floating flange, left, and fixed flange. ID's 2" through 16".

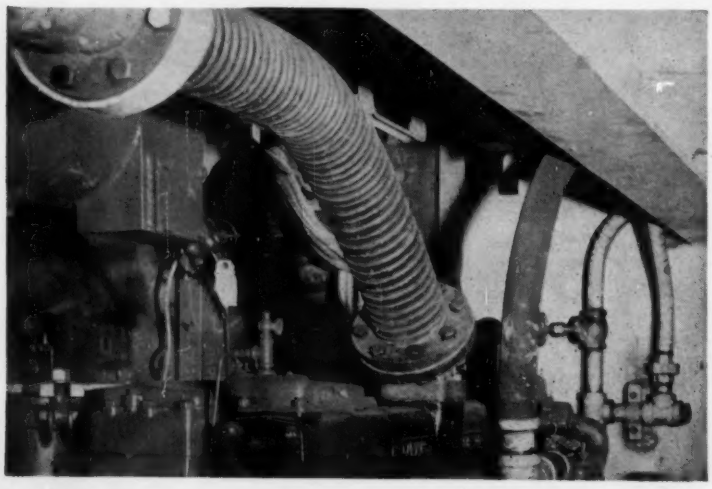
Type Y-10 hose with welded nipple, supplied with or without flange.

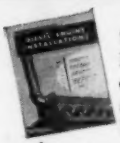


Floating flange.

Type S-1 braid-covered seamless flexible metal tubing for air, oil and water lines. Seamless tubing is 100% tight and extremely flexible. ID's ⅛" through 12". Usually furnished with fittings attached.

Below: Flexible, corrugated steel hose carries hot diesel exhaust gases to atmosphere.





WANT MORE INFORMATION? Bulletin EH-50 gives detailed engineering data on American flexible metal hose and tubing for diesel engines. We'll be glad to send you a free copy, or have one of our sales engineers call. No obligation of course. Address *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.* In Canada: *The Canadian Fairbanks-Morse Company Ltd.*

WHEREVER CONNECTORS MUST MOVE

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FLEXIBLE METAL HOSE AND TUBING

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OVER ONE HUNDRED MILLION MILES OF PROVEN COMMERCIAL OPERATION

With 30 Years of Extensive Research and Production Experience in the Supercharging Field, Schwitzer Now Offers a Complete Line of 4 Sizes of Turbochargers For 50 to 1200 HP Installations. Now in Production in All Heavy Duty Fields—Truck-Tractor-Stationary-Marine.

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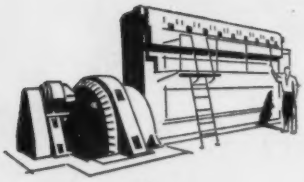


"Cured... bearing failure in their diesel-driven, front-end loaders"

A large fire-brick manufacturing company in the Philadelphia area had the problem of premature bearing failure in its diesel-driven loaders and shovel.

Headlights on even in daylight...

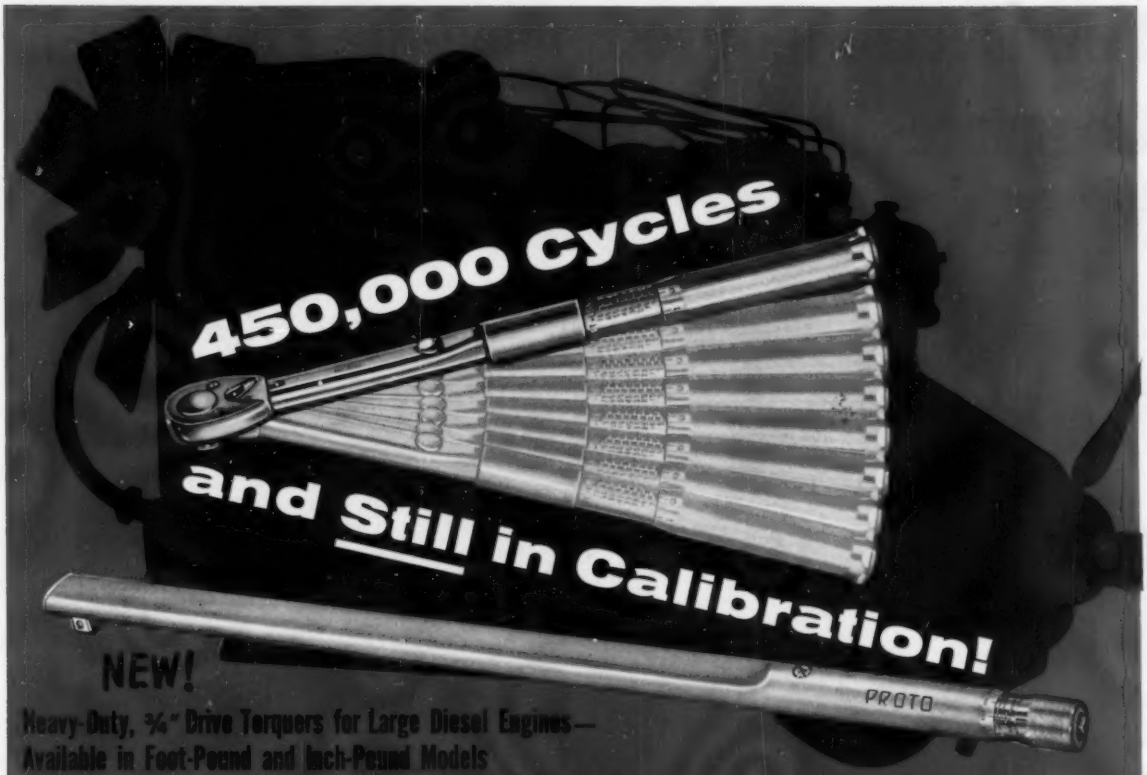
Sinclair Lubrication Engineer Harry Donovan reports, "These units were operating around the clock under conditions *so dusty that headlights were required.* Crankcases had to be drained and flushed bi-weekly! My first recommendation was closer adherence to an air filter maintenance program."

Drain intervals doubled!

Mr. Donovan continues, "Further observation proved to me that excessive idling and overloading were all contributing factors to a severe sludge condition. I recommended Sinclair SUPER TENOL® – explaining that the superior quality of the base oil plus the Sinclair formulated additives would extend bearing life *while at the same time removing accumulated lacquer and sludge.* A trial period proved SUPER TENOL doubled drain intervals and eliminated flushing entirely. This company now uses Sinclair SUPER TENOL exclusively."

Why not give a Sinclair Lubrication Engineer the chance to solve *your* lubrication problems? *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS



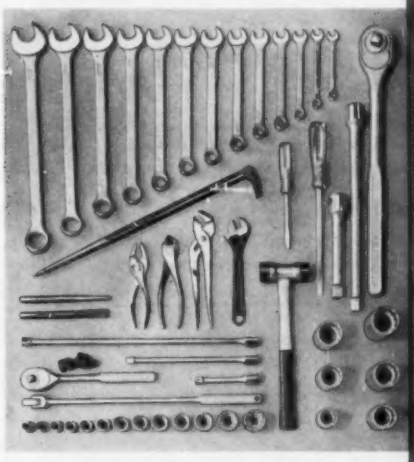
NEW!

Heavy-Duty, ¾" Drive Torquers for Large Diesel Engines—
Available in Foot-Pound and Inch-Pound Models

Severe tests of the amazing PROTO Torquer have resulted in its approval and widespread use by many manufacturers and users of diesel engines. A large producer of diesel engines subjected a Torquer to 450,000 torquing cycles and found the tool still in calibration within specified tolerances! A diesel locomotive company, after exhaustive tests, added PROTO Torquers to its railroad catalog. Reasons for the Torquer's acceptance by railroads, other diesel users and manufacturers are many. They like its *automatic* release, great speed (fastest in the World), accurate micrometer-type adjustment, rugged trouble-free design, and absence of pointers, dials and other "gadgets." Besides ¾" drive, heavy-duty "giants," the line includes models in ½", ⅜" and ¼" drives—providing a wide range for diesel work. Ask your PROTO dealer for an on-the-job demonstration of the fabulous Torquer. Send 10c for 68-page catalog showing the entire PROTO line to

PLOMB TOOL COMPANY
2274Z Santa Fe Ave., Los Angeles 54, Calif.

ALSO NEW!
No. 9940 Set for Diesel Maintenance



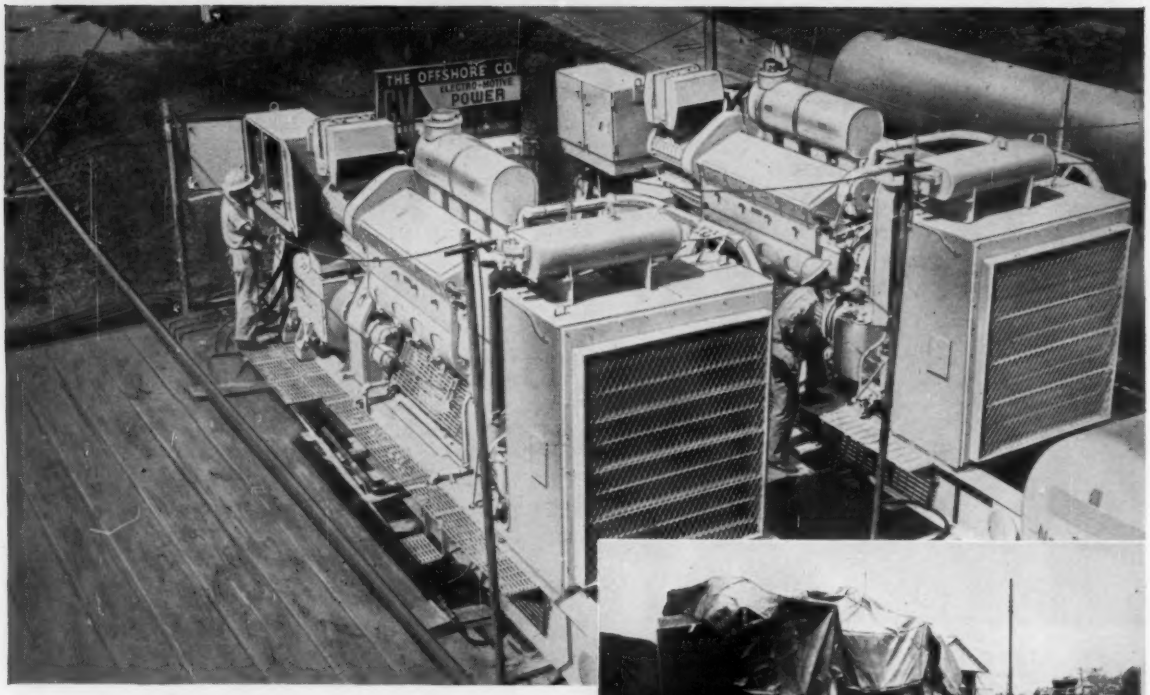
In one carefully selected professional quality set you get 51 of the most necessary tools for diesel engine maintenance. The set includes end wrenches, an adjustable wrench, socket wrenches and attachments in two drive sizes, pliers, screwdrivers, a bar, a soft-faced hammer, a punch and a chisel.

PROTO® TOOLS
PROTO means PROfessional TOols

Eastern Factory—Jamestown, N.Y.
Canadian Factory—London, Ont.

3498

New Electro-Motive Drilling-Rig Power Plant Completes First Hole...for Offshore Company



The first Diesel-Electric drilling-rig power units built by Electro-Motive drilled their first hole to a depth of 12,000 feet for The Offshore Company of Baton Rouge, La. A second hole is now being drilled.

These flexible units offer the petroleum industry an entirely new concept in a Diesel-Electric drilling rig. A compact, lightweight package with all components engineered, built and backed by *one* manufacturer, the Electro-Motive unit features simplified control and rugged dependability at a cost far below that of previously built Diesel-Electric rigs and comparing favorably with Diesel-mechanical rigs.

Basic unit consists of eight-cylinder General Motors 567C two-cycle Diesel engine—developing 875 continuous horsepower—mounted on portable skid with two generators, generator control cabinet and engine cooling apparatus. Direct current electricity from the generators is supplied by cable to the 625-horsepower motors which, singly or in pairs, supply power for the mud pumps, draw works and rotary table.

Unmatched Flexibility

Power transmission cables are quickly and easily connected and disconnected with no bolting or taping required. Thus setup time is reduced to a minimum. Engine-generator units in land operation can be placed anywhere near the drilling site, with no need for heavy foundations or worry about alignment with mud pumps, draw works and rotary table as is required with mechanical rigs. In offshore operations, the advantage is that Electro-Motive power can be put into a minimum of space with important savings in high-cost deck area of barge.

Maximum portability of Electro-Motive Power Units is shown in this photo of skid-mounted 8-cylinder Diesel engine-generator set being delivered to Offshore Company drilling site near Houma, La.

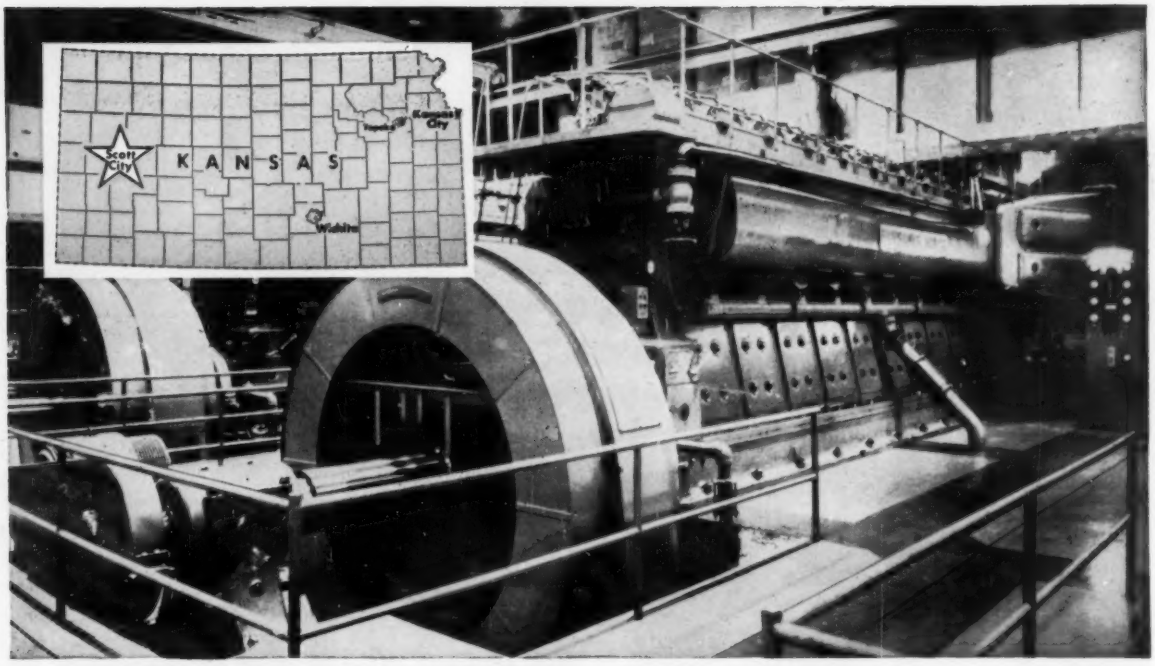
For further information, write or call your nearest Electro-Motive representative.

Electro-Motive Division offices located in New York City, Chicago, Jacksonville, St. Louis, Tulsa and San Francisco.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS • *In Canada:* GENERAL MOTORS DIESEL, LTD., *London, Ontario*

World's Largest Builder of Heavy-Duty Diesel Engines and Electric Traction Equipment

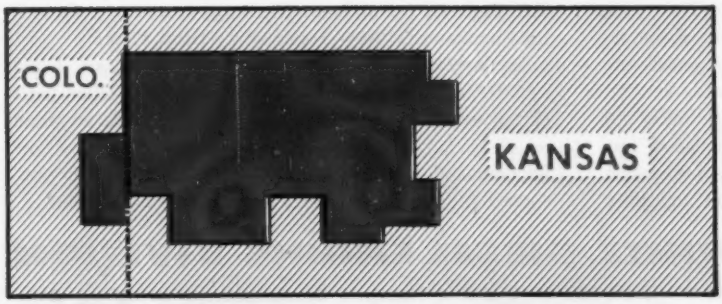


Largest REA Plant in Kansas Reports Cities Service DC-840 Diesel Oil Excellent!

Fairbanks-Morse Diesels of Wheatland Electric Cooperative, Inc. give outstanding performance using DC-840 Oil for power cylinder and crankcase lubrication. Here are the results Wheatland achieved:

1. House operation each unit—13,000 hours.
2. No oil changes due to oil failure.
3. No overhaul or major breakdown.
4. Rings free in groove with little or no signs of wear.
5. Oil consumption within mfgr's. recommendation.
6. Fuel consumption 10,572 BTU/KWH, load factor 63.7%.
7. Maintenance of lubricating oil at minimum expense.
8. 3500 H.P. hours per gallon of lubricating oil.
9. No wear on main or rod bearings.
10. No oil change at end of 9,000 hours.

For similar results in your Diesel operation, contact your nearest Cities Service office or write to Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



WHEATLAND ELECTRIC COOPERATIVE, INC. serves 3,300 square miles in all or part of Scott, Wichita, Hamilton, Greeley, Kearny, Wallace, Logan and Finney Counties in Kansas as well as sections of Kiowa and Prowers Counties in neighboring Colorado. Also supplies wholesale the Lane-Scott Cooperative serving 2,200 square miles in 6 Kansas Counties.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Superior DUAL-FUEL ENGINES

CUT OPERATING COSTS

in New York sewage treatment plant

Six Model 80 Superior Dual-Fuel Engines, operating 92% of the time on sewage gas, run six 1125 KVA generators to provide the sole power source for all plant equipment at The Department of Public Works, Owl's Head Sewage Treatment Plant, New York City, having a capacity of 160 million gallons per day.

After a total of 78,000 hours running time, the New York maintenance crew completed the first overhaul of the six Superior engines. Practically no major part replacements were necessary! There was no noticeable wear on the cylinder liners, bearings or other vital parts! Since the engines were torn down, piston rings were replaced; but the old rings were still good enough to save for spares! Records show very low lube oil consumption and pilot fuel costs figure out to only 9 tenths of a mill per KWH. This Superior performance is cutting operating costs to a bare minimum at New York's Owl's Head Plant!

Similarly outstanding performance records are being established throughout the U.S.A., and most other parts of the world where Superior and Atlas Diesels are used for all kinds of power needs. For complete details on how Superior and Atlas power can cut operating costs for you, contact the nearest sales and service office listed below.

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

WHITE DIESEL ENGINE DIVISION

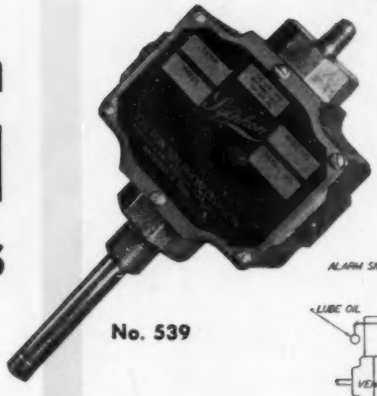
THE WHITE MOTOR COMPANY • ***Plant and General Offices: Springfield, Ohio***

SALES AND SERVICE POINTS: Gloucester, Mass. • Houston, Ft. Worth, Texas • San Diego, Oakland, Terminal Island, California • Ketchikan, Alaska • Washington, D.C. • Portland, Astoria, Oregon • Casper, Wyoming • Halifax, Nova Scotia • Vancouver, B.C. • Park Rapids, Minnesota • New York • Chicago • Seattle • New Orleans • St. Louis • Wichita, Kansas

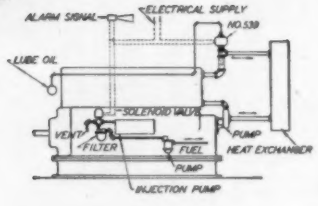
Why take chances on engine trouble?

Depend on SYLPHON controls

No. 923-3



No. 539



Typical installation of No. 539.

YOU NEVER NEED to cross your fingers —or trust to luck—with these Sylphon controls. When they're on the job, they safeguard you against engine trouble—day and night. They help ward off costly shutdowns, damage or repairs.

No. 539 control gives positive protection against high jacket water temperature or low lube oil pressure. If water jacket temperature goes above, or lube oil pressure goes below safe limits, it sounds an alarm—or shuts off the engine. Also available for temperature or pressure only.

No. 923-3 Regulator is equally dependable. It thermostatically controls cooling water circulation—keeps engine jacket temperature right. Can be manually operated —if and when desired!

Both controls are ideally suited to diesel, gas or other internal combustion engines. Self-contained and self-powered, they're built to give you long, trouble-free service. Easily installed. For complete information, send for Bulletin TD-817.

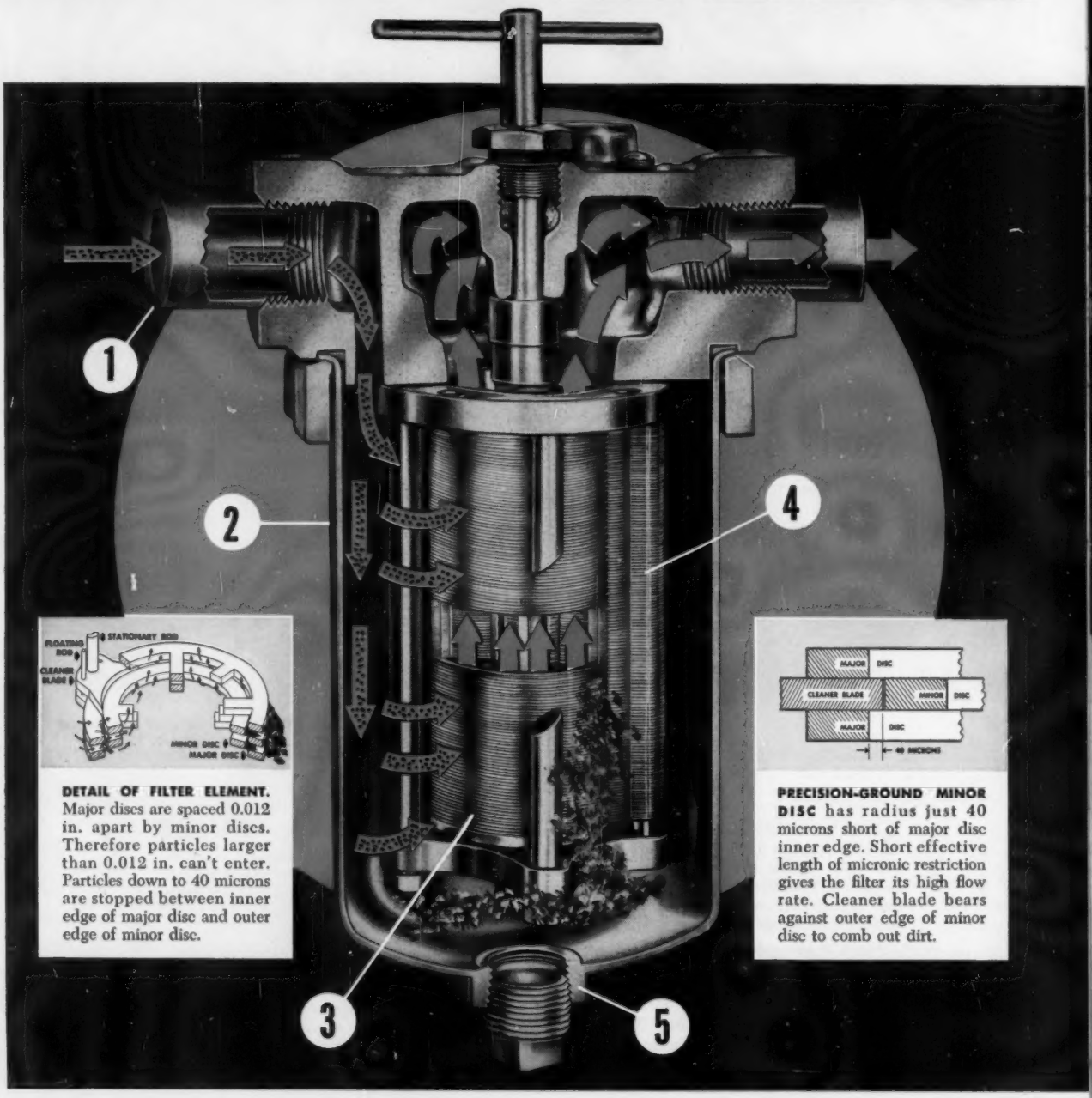
Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION

Temperature Controls • Bellows Devices • Bellows Assemblies

KNOXVILLE 1, TENNESSEE

New CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY OF NEW SUPER AUTO-KLEAN. Dirty oil enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean oil rises through center of filter element, leaves at right.

self-cleaning filter!

THE *Super* AUTO-KLEAN

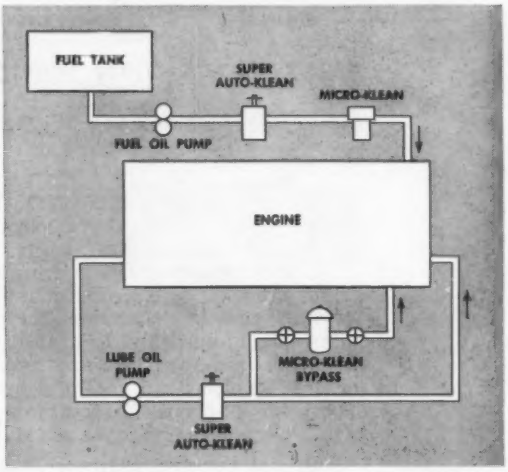
FOR FULL-FLOW LUBE AND FUEL

. . . and you can clean this filter by simply turning the handle!

Cuno's new Super AUTO-KLEAN filter now makes possible economical, compact full-flow micronic filtration for small high-speed diesels, and requires no more space than present bypass filters. Super AUTO-KLEAN makes full-flow filtration on large low-speed diesels more economical than ever before. Here's what it offers:

1. Full-flow micronic filtering with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.
2. Eliminates cartridge changes.
3. No pressure drop build-up (saves pumping horsepower). An 8-in. long, 2¾-in. diameter cartridge handles 25 gpm of lube oil of 200 SSU viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.
4. Positive engine protection against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.
5. No need to use large, expensive, high-maintenance cartridge filters. Oil can be kept in top shape with small, inexpensive bypass CUNO MICRO-KLEAN filter to remove particles smaller than 40 microns. Bypass cartridge lasts longer because it's not clogged with particles larger than 40 microns.
6. No duplex units needed. Super AUTO-KLEAN handles full flow all the time with no interruptions for cleaning.
7. Can't absorb or adsorb additives from the oil because it's all metal.
8. Uses standard AUTO-KLEAN housing on existing AUTO-KLEAN installations. You can easily replace most 2¾-in. diameter cartridges with Super AUTO-KLEAN for finer filtration.
9. Can be adapted to any existing engine. Simply install Super AUTO-KLEAN in the full-flow lube oil line following the discharge of the engine pump.
10. Gives lower initial costs, lower installation costs, requires less space than cartridge-type full-flow units. You get high capacity in a small package.

Send coupon for complete information on the new Super AUTO-KLEAN filter for your new or existing diesels. Cuno Engineering Corporation, Dept. 101-S, South Vine Street, Meriden, Conn.



SIMPLIFIED SET-UP for ideal lube oil filtration. Full flow goes through Super AUTO-KLEAN and is cleaned of particles 40 microns and larger on every pass. A CUNO MICRO-KLEAN replaceable-cartridge filter may be used where conditions warrant further clarification. Various element densities available to remove particles down to one micron. Housings available for either partial flow (as shown above) or full-flow hook-ups.

5.1

MAIL COUPON FOR COMPLETE INFORMATION

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (disc-type) • **MICRO-KLEAN** (fibre cartridge)
FLO-KLEAN (wire-wound) • **PORO-KLEAN** (porous metal)

CUNO ENGINEERING CORPORATION
Department 101-01
South Vine Street, Meriden, Conn.

Please send me full data on the NEW Cuno Super AUTO-KLEAN filter.

Name_____

Firm_____

Position_____

Address_____

City_____ Zone_____ State_____

RIGHT-NOW SWAGED HOSE ASSEMBLY SERVICE

AT YOUR WEATHERHEAD DISTRIBUTOR

Any hose assembly made in 3 minutes

RIGHT IN HIS OWN SERVICE SHOP!

Now, for the first time, your Weatherhead distributor offers you complete swaged hose assembly service right in his own shop. No waiting for shipments of factory-finished hose assemblies. No need for costly downtime and delay. Equipped with the new Weatherhead swaging press and the complete line of Weatherhead hose and hose ends, your distributor is prepared to supply you with any size, type and length hose assembly at once.

Wherever you are, whatever your need, there is a Weatherhead distributor strategically located to give you immediate stand-by swaged hose assembly service.

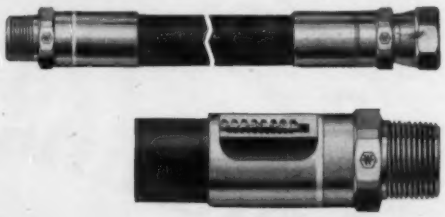
WEATHERHEAD

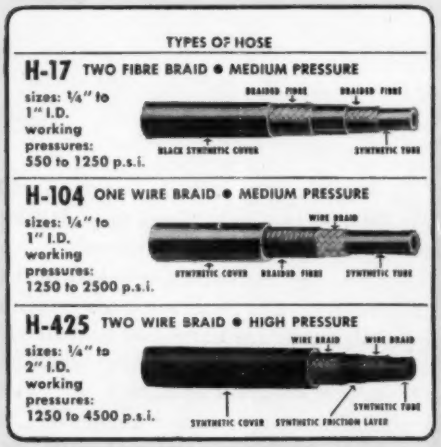
The Weatherhead Company, Fort Wayne Division, Dept. E-10, 128 West Washington, Fort Wayne, Indiana

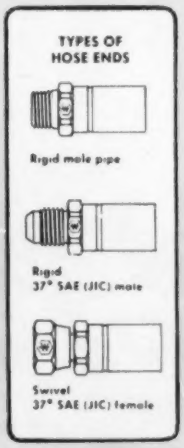
Now available at
WEATHERHEAD DISTRIBUTORS

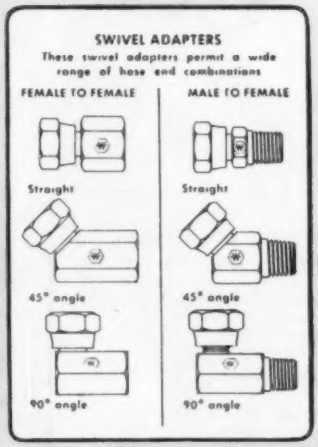
WEATHERHEAD—Your Only Complete Single-Source Hydraulic Hose and Fitting Line. Any industrial hose for any need—low, medium-high and high-pressure applications; available in complete size ranges to 2" I.D.; suited for any service condition.

Weatherhead swaged hose assemblies match factory-made assemblies in every respect. They're available in any quantity, length, type or size to meet your needs and at no additional cost to you. Take advantage of your local Weatherhead distributor's dependable RIGHT-NOW swaged hose assembly service. Another Weatherhead first . . . component parts for Hydraulic Hose lines.









WEATHERHEAD LEADS THE WAY

Send for full details TODAY!

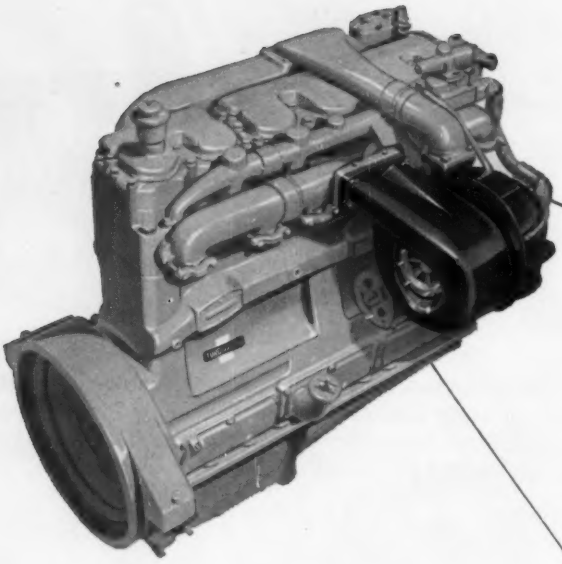
The Weatherhead Co., Fort Wayne Division
128 West Washington, Fort Wayne, Indiana

Send full details on your Distributor's Stand-by Swaged Hose Assembly Service.

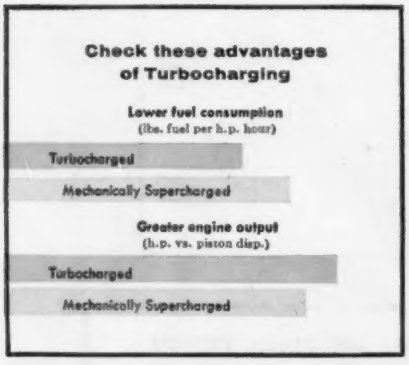
Company _____

Address _____

Your Name _____



Cummins Turbodiesels



Five new Cummins Turbodiesels (175 . . . 250 . . . 262 . . . 300 . . . and 600 h.p.) now feature the sensational new development—exhaust gas turbocharging of high-speed diesels.

They give you more economy . . . better performance than naturally aspirated or mechanically supercharged engines. Exhaust gas energy normally wasted is harnessed to achieve a more perfect air-fuel mixture in the combustion chamber, without any parasitic load. (See diagram at right.)

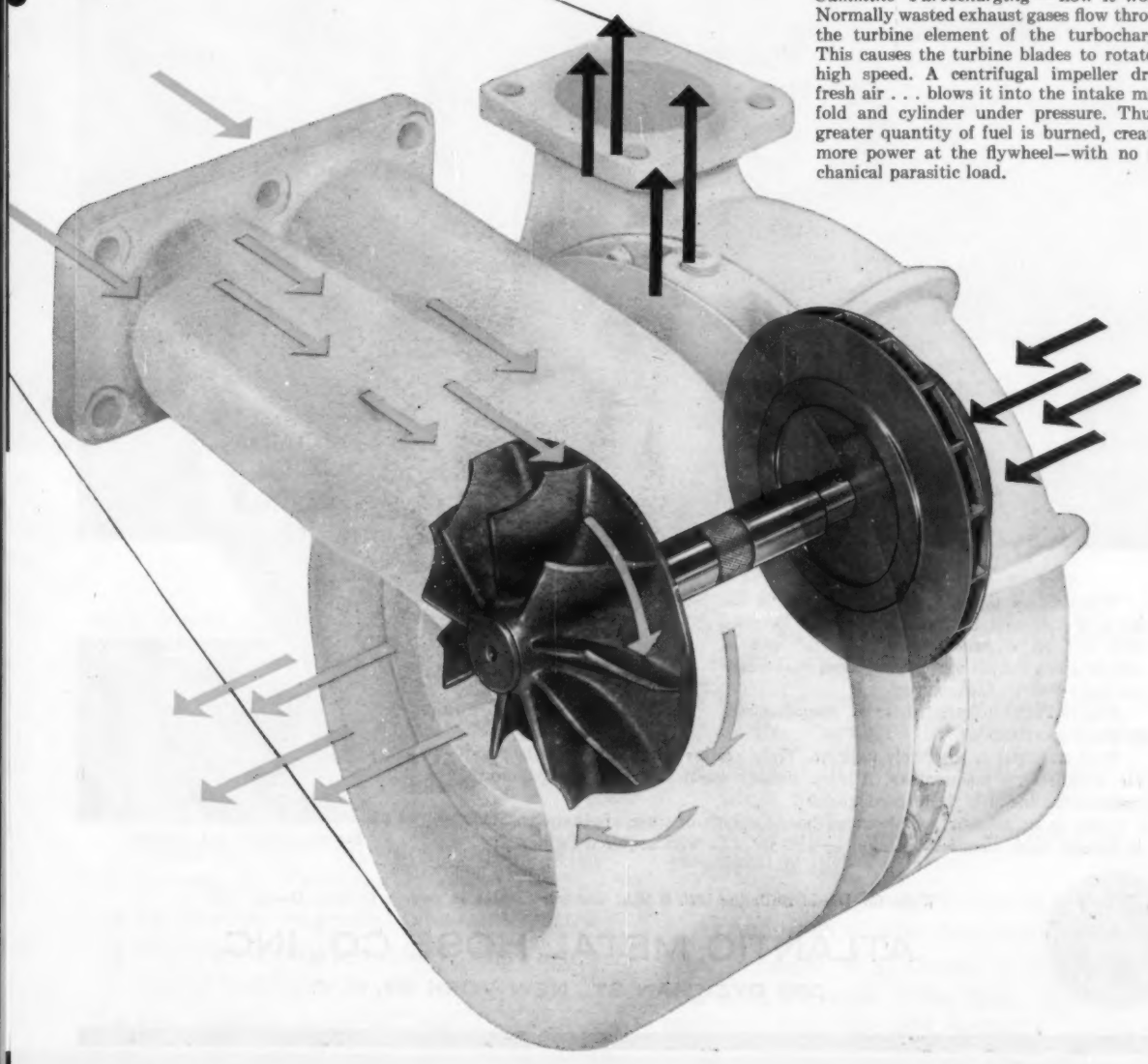
If you want reduced fuel costs . . . longer engine life . . . lowest possible weight per horsepower . . . and maximum profits . . . get full details on Cummins Turbodiesels from your nearest Cummins Distributor.

Cummins Diesels are available in the equipment of over 40 leading manufacturers.

CUMMINS

Cummins Engine Company, Inc. • Columbus, Indiana

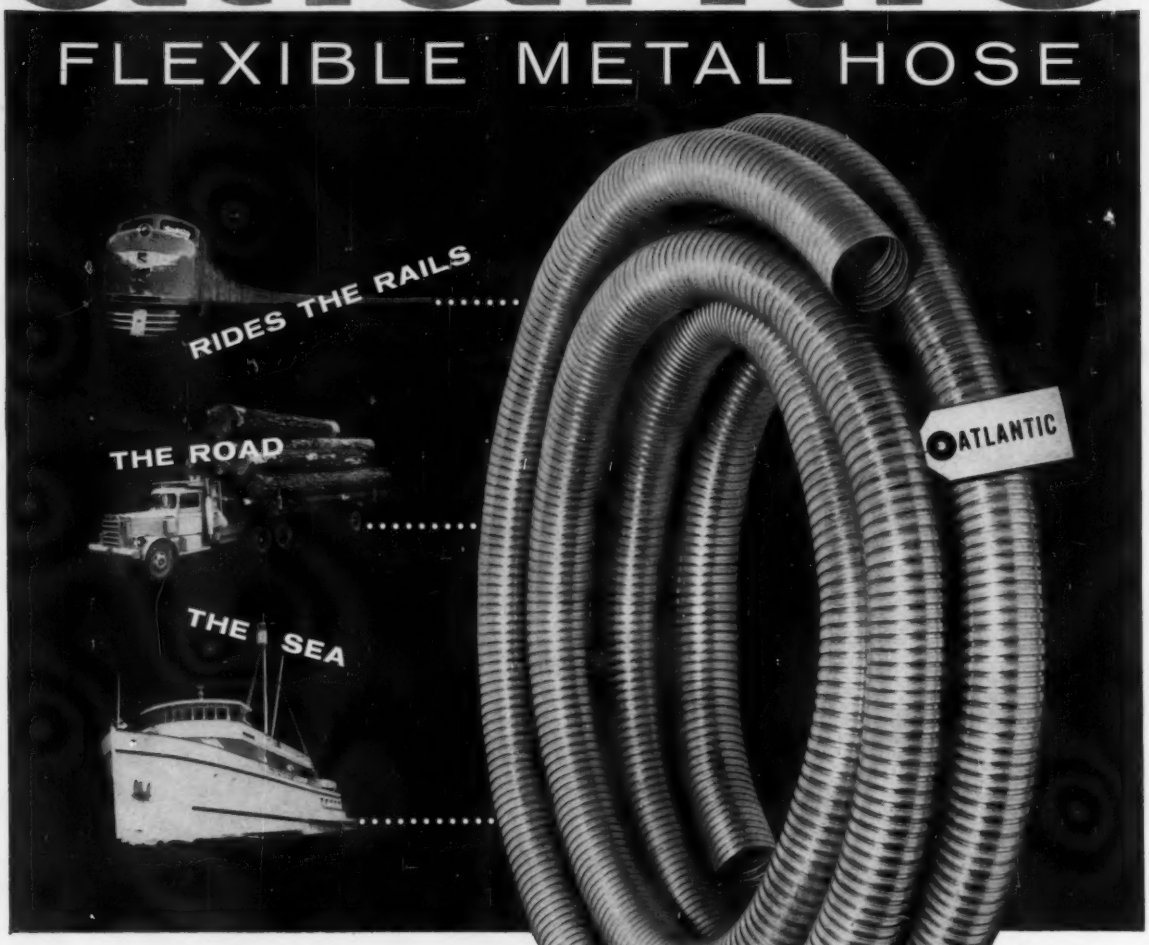
. . put waste heat to work!



Cummins Turbocharging — how it works. Normally wasted exhaust gases flow through the turbine element of the turbocharger. This causes the turbine blades to rotate at high speed. A centrifugal impeller draws fresh air . . . blows it into the intake manifold and cylinder under pressure. Thus a greater quantity of fuel is burned, creating more power at the flywheel—with no mechanical parasitic load.

atlantic

FLEXIBLE METAL HOSE



When diesels power trucks hauling 70,000 lb. loads of logs over mountain roads — or locomotives and ships, Atlantic flexible metal hose is usually given the job of guarding those vital diesel life lines—water, fuel, exhaust.

Atlantic flexible metal hose is manufactured to tough specifications.

Wall thickness is absolutely uniform. Tight against water, oil, steam, gas and air. Requires no maintenance. Atlantic flexible metal hose dampens vibration, remains flexible at higher temperatures.

There is an Atlantic flexible metal hose for each of these applications. Made in bronze, steel, stainless and monel—⅛"-36" I.D. with required fittings.

For misalignment and vibration

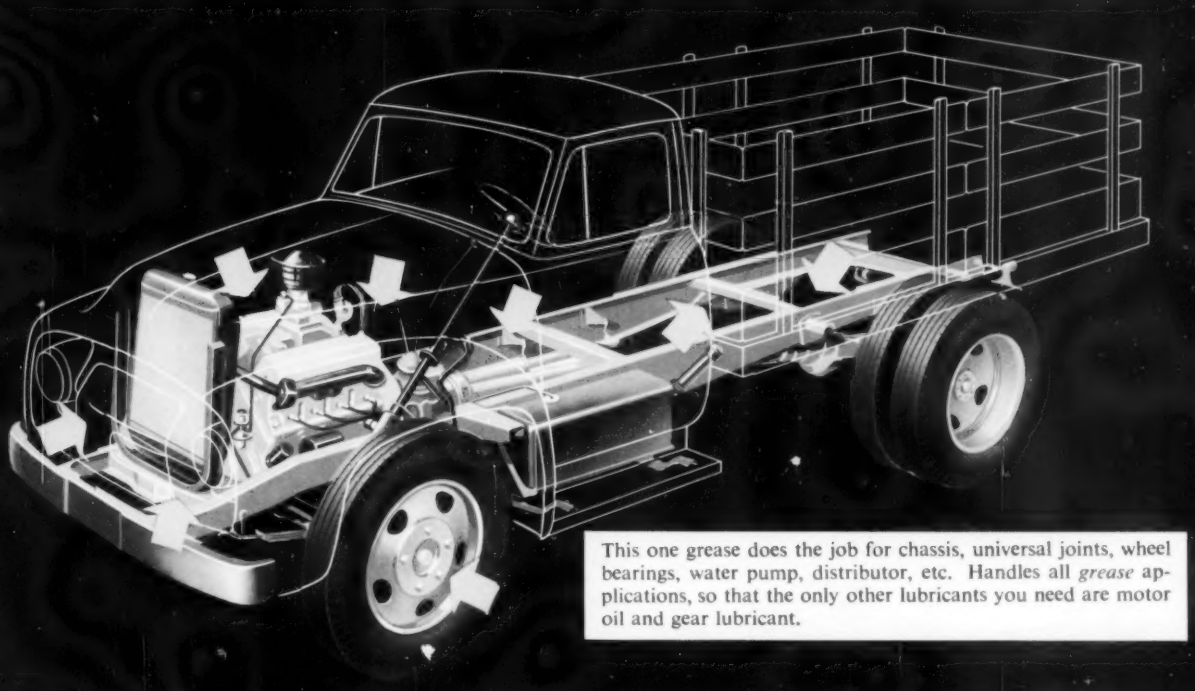
JOB-TESTED CERTIFIED

Write for Diesel Bulletins 1020 & 50A. See our Catalog in Sweet's Product Design File.

ATLANTIC METAL HOSE CO., INC.

309 DYCKMAN ST., NEW YORK 34, N. Y.

Now one grease is all you need



This one grease does the job for chassis, universal joints, wheel bearings, water pump, distributor, etc. Handles all *grease* applications, so that the only other lubricants you need are motor oil and gear lubricant.

New Purelube M.S. grease replaces all single-purpose greases . . .

New Purelube M.S. Grease is a new multi-service grease specifically made for automotive use (*not a rebrand of an industrial grease*). It handles every grease application in every unit of your fleet—and it lubricates every point better than single-purpose lubricants. Here's why:

- New Purelube M.S. Grease is completely water resistant—provides absolute protection against "washout."
- Gives superior protection against rust.
- Has high impact resistance—won't splatter out of bushings.
- Has melting point of 390° F.—provides safe lubrication for high temperature operation.
- Can be pumped at temperatures below 0° F.—stays on the job in cold weather.
- Passes CRC Wheel Bearing Test—results show new Purelube M.S. Grease gives better protection than conventional wheel bearing lubricants.
- Inhibited against oxidation—withstands conditions of time and temperature.

New Purelube M.S. Grease is the *only grease* you need for your entire fleet. Use it. Avoid mistakes, save time and money!

See how this great new grease simplifies your entire lubrication program

Now lubricate your entire fleet with only 3 Pure Oil lubricants

3

Purol H.D. Motor Oil

for clean, smooth-running engines. Protects against wear, sludge, rust, corrosion and foaming. High viscosity index reduces oil consumption. Now meets General Motors Allison Division requirements for Hydraulic Transmission Fluid-Type C.

Purelube Multi-Purpose Gear Lubricant

for differentials, transmissions and steering gears. Meets the requirements of two SAE viscosity grades. Non-foaming, non-corrosive. Meets Timken Detroit Axle Co. requirements as well as those of the military specifications MIL-L-2105.

New Purelube M.S. Grease

for all other lubrication. Makes lubrication faster and easier. Eliminates mistakes. Saves money. Use Pure Oil's "Simplifying 3" for your fleet.

Send for free folder
The Pure Oil Company, Dept. 85
35 E. Wacker Drive, Chicago 1, Ill.

Yes, send me the free folder giving complete information on new Purelube M.S. Grease.

Name_____

Company_____

Street_____

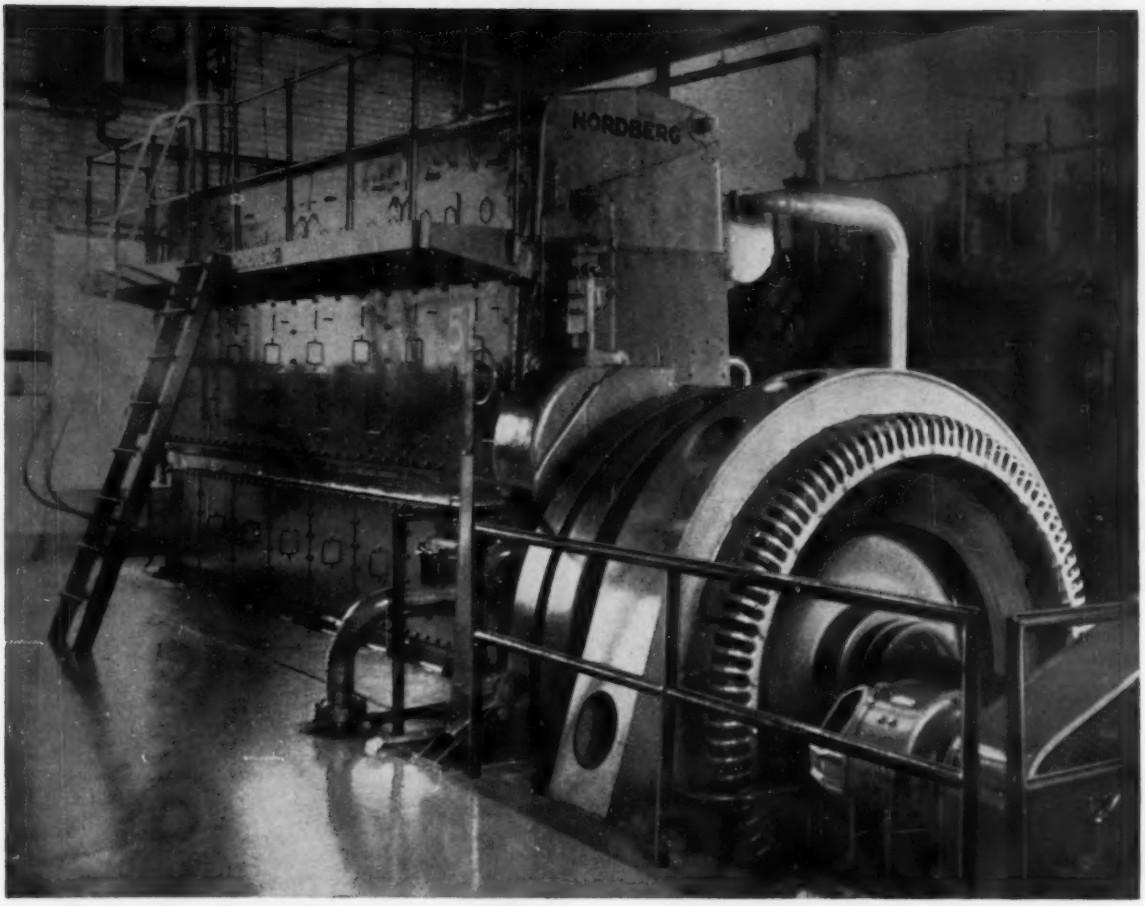
City_____ Zone_____ State_____

Be *sure* with Pure

BE SURE PURE WITH PURE

Sales offices located in more than 500 cities in Pure's marketing area.

5190



After 30,000 hours Koppers Piston Rings still maintain "excellent" compression

At the Neodesha Municipal Power Plant, Neodesha, Kansas, Koppers Piston Rings are an important part of the 1750 bhp. Nordberg Duafuel Engine illustrated above. After 30,000 hours of operation the pistons on this engine have never been pulled, and compression is still excellent. It is interesting to note that this Nordberg Engine, equipped with Koppers Piston Rings, has been in operation over 98% of the time—and carries about 90% of the plant load.

Koppers has widely experienced engineers and extensive manufacturing facilities which combined can fill the most difficult of piston ring requirements. Next time you are concerned with piston rings or sealing rings, whether in replacement or new installations—in engines large or small—call on Koppers. Never any obligation, of course. For more information, mail coupon.

KOPPERS

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland

This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with *Service*

AMERICAN HAMMERED

Industrial Piston Rings

KOPPERS COMPANY, INC., ***Piston Ring and Seal Dept.,*** **1640 Hamburg Street, Baltimore 3, Md.**

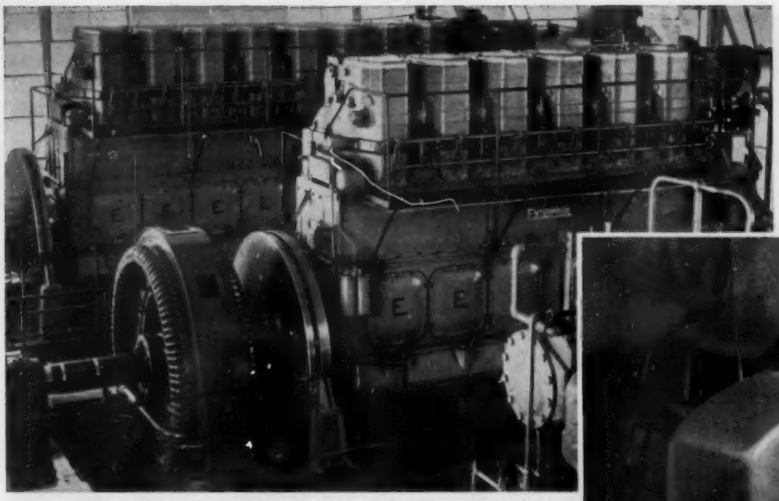
Gentlemen: Please send me free 16-page booklet containing full information on Piston Rings.

Name.....

Company.....

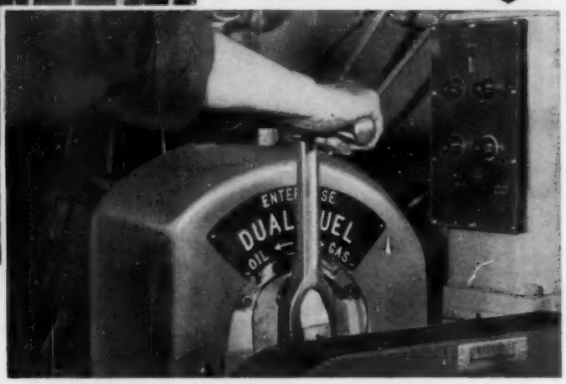
Address.....

City.....Zone.....State.....



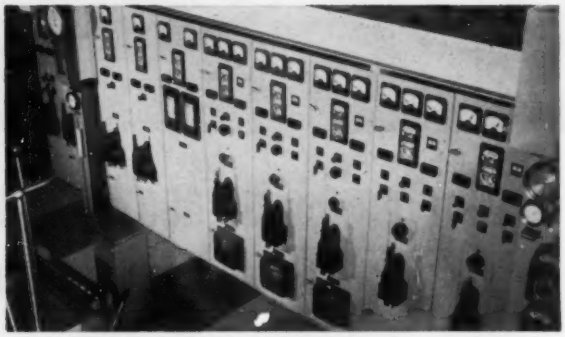
The two Enterprise Diesels were equipped for "Select-O-Matic" Dual Fuel operation in the field after installation, taking full advantage of low-cost gas for fuel.

A single lever simplifies fuel selection. After manual setting, any fluctuation in gas pressure is compensated for automatically, thereby maintaining constant engine speed and load.



City of Broken Bow, Nebraska, Switches to Enterprise Dual Fuel—Saves $36,000 a Year!

Broken Bow's model municipal utility plant is under the capable supervision of L. E. Clark. *"These Enterprise Engines have given us exceptional performance in every way,"* says Clark, *"we're more than satisfied with their excellent record."*



Modern control panel keeps tab on plant production. A unique "Metered Maintenance" plan developed by Mr. Clark keeps operating and maintenance costs at a minimum.

Electricity comes cheap at Broken Bow, Nebraska, where two Enterprise "Select-O-Matic"® Dual Fuel Engines, running on natural gas with pilot oil, have cut $100 a day in fuel costs since their installation three years ago. Because of their low cost operation, they have virtually replaced the three original engines, which are now used for standby and peak load service only.

Intercooling boosts output. Even though Broken Bow's summer and winter temperatures vary greatly, the Enterprise Engines, through Intercooling, run at full load with no increase in temperatures or pressures. The result is greater KW output and economy.

The real payoff has been in greatly reduced electric rates, and a modern, dependable power plant that has paid for itself and is contributing to the general improvement fund.

Get full information on Enterprise Engines today. Units from 73 to 6933 HP in Diesel, Dual Fuel, Tri-Fuel, Spark Ignited Gas—for every stationary, municipal, and marine use.

Over a million horsepower at work the world over!

ENTERPRISE
dependable **ENGINES**

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California
Export Department, New York

Boston • Chicago • Denver • Des Moines • Fort Worth • Huntington • Jacksonville • Kansas City • Los Angeles
Minneapolis • New Orleans • New York • Pittsburgh • San Diego • Seattle • St. Louis • Tulsa • Washington, D.C.

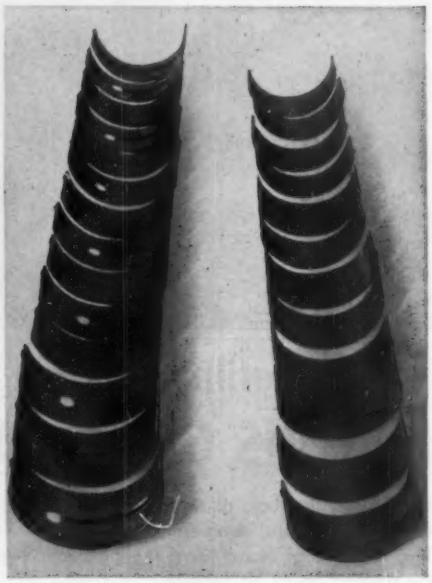
The Engineer's Field Report

CASE HISTORY

LUBRICANT RPM Delo Oils

FIRM Nelson Logging Co., Twain Harte, Calif.

Trucks work 4 years with no lost bearings on tough, high-mountain logging job!



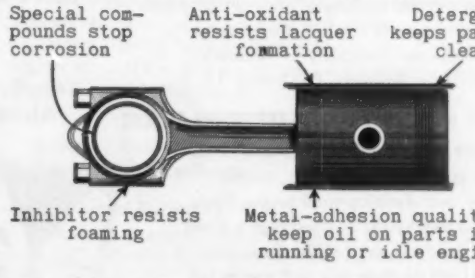
In hauling 25-ton payloads out of the Sierra Nevada Mountains, Nelson Logging Co.'s 10 International trucks like the one above operate in lower gears more than half the time—often in low and compound low. Using RPM DELO Special Lubricating Oil, they have not had a single bearing failure in four years of tough service where mountain roadbeds always are either deep dust or heavy mud and snow. Bearings above show typical good condition after three years of this rugged work. "We get an average of 3 years service from piston assemblies in our trucks," says Slim Meissen, Master Mechanic. "'RPM DELO' keeps all our engines clean, rings free and wear exceptionally low." Nelson Logging Co. uses RPM DELO Oils in all equipment—the 10 logging trucks, 11 other gasoline-powered units, 6 diesel tractors and a loading crane.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U. S. PAT. OFF.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why RPM DELO Oils prolong engine life


Special compounds stop corrosion
Anti-oxidant resists lacquer formation
Detergent keeps parts clean
Inhibitor resists foaming
Metal-adhesion qualities keep oil on parts in running or idle engine

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Versatility . . . Light Weight . . . High Heat Conductivity!

PISTONS OF ALCOA ALUMINUM HAVE ALL THREE!

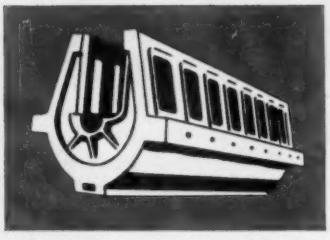
Only Alcoa produces all three types of pistons —permanent-mold, semipermanent-mold, and forged. Sizes of Alcoa® Pistons range from the smallest to 21" in diameter, and they may be ordered with or without inserts for added ring groove life.

Alcoa Aluminum Pistons weigh less—making possible increased engine speeds and resulting in increased horsepower.

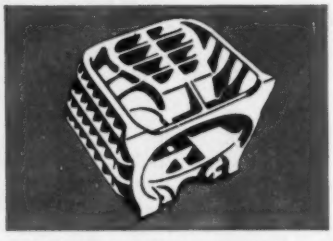
Aluminum's high heat conductivity lowers surface temperatures and allows greater engine output without increasing operating temperatures. To get the complete story on *all* Alcoa Aluminum products for the diesel industry, write: Aluminum Company of America, 1988-K Alcoa Building, Pittsburgh 19, Pa.

NEW TYPE OF PISTONS FOR FUTURE ENGINE DESIGNS

For diesel manufacturers who now have engines in the design stage, Alcoa's research and development teams have produced new types of aluminum pistons which embody many highly desirable features. While they are not yet in full production, Alcoa is ready to talk to manufacturers of high output engines—and to discuss the possibilities of *greater power from the same size engine!*



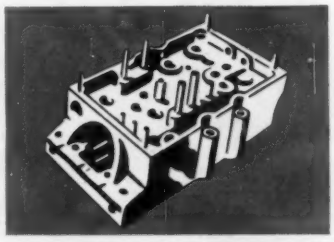
CRANKCASES AND FRAMES of lightweight Alcoa Aluminum give diesels higher horsepower-to-weight ratios, increase efficiency in operation.



SUPERCHARGING AND SCAVENGING are more efficient through the use of aluminum. Here, too, diesels can save weight through the use of aluminum.

Your Guide to Aluminum Value

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA
©ALCOA



CYLINDER HEADS of Alcoa Aluminum distribute heat better, allow increased engine ratings. They also mean lighter weight, easier servicing.

Cutaway view of Deutz Air-Cooled V-type Diesel, showing finned design around combustion area. Heads and cylinders easily removed individually

DEUTZ

the world's first full line of

AIR-COOLED DIESELS

With a vast record of successful routine performance in temperatures ranging from 140°F to —40°F, DEUTZ Air-Cooled Diesels are known the world around as the rugged power units that feature dependability, simplicity, and economy.

DEUTZ Air-Cooled Diesels are built with horsepower ratings from 5 to 250, and in 1, 2, 3, 4, 6, 8 and 12-cylinder models. Their air-cooling system provides easier, quicker starting and faster warm-up. They operate at higher temperatures which yield higher efficiency and freedom from corrosion problems related to sulphur content of most fuels.

The greater accessibility of engine parts, with each cylinder and head removable separately in the absence of surrounding water jackets, greatly expedites inspection, maintenance, or repair work when necessary.

DEUTZ also builds special water-cooled Diesels from 3 to 2000 HP for automotive, marine and stationary use.

DEUTZ Diesels, built in West Germany by the world's pioneer in internal combustion engines, are available in your area now. Send in the coupon for complete information.

DEUTZ

DIESEL ENERGY CORP.

82 BEAVER STREET, NEW YORK 4, N. Y.

Diesel Energy Corporation
Dept. C
82 Beaver St., New York 4, N. Y.

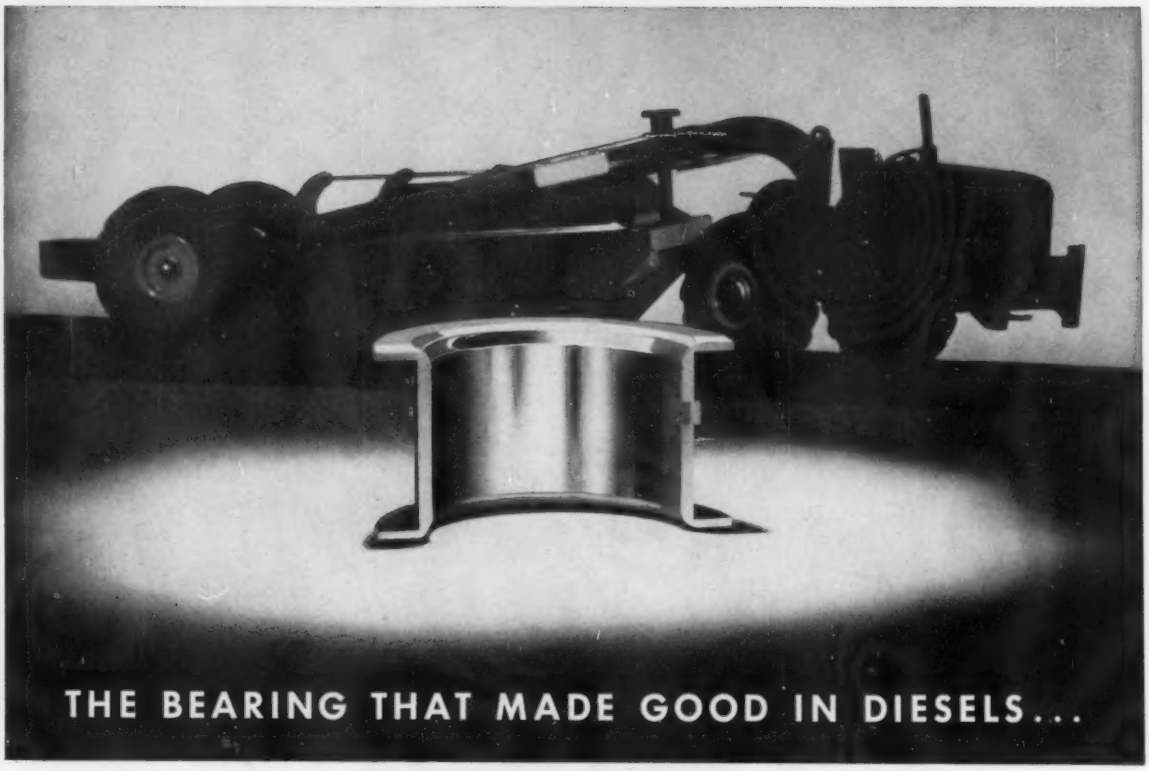
Please send complete information on DEUTZ Diesels. I am interested in ☐ Air Cooled ☐ Liquid Cooled Models of about _____ HP.

Name_____

Firm_____

Address_____

City_____ Zone____ State_____



JOHNSON Aluminum on Steel

Right here has been developed the greatest sleeve bearing in years—Johnson Aluminum-on-Steel. This patented combination of metals is especially suited to take the heavy loads and shocks required of much diesel power. The physical properties of aluminum bonded to steel assure long, trouble-free service. Write for full information.

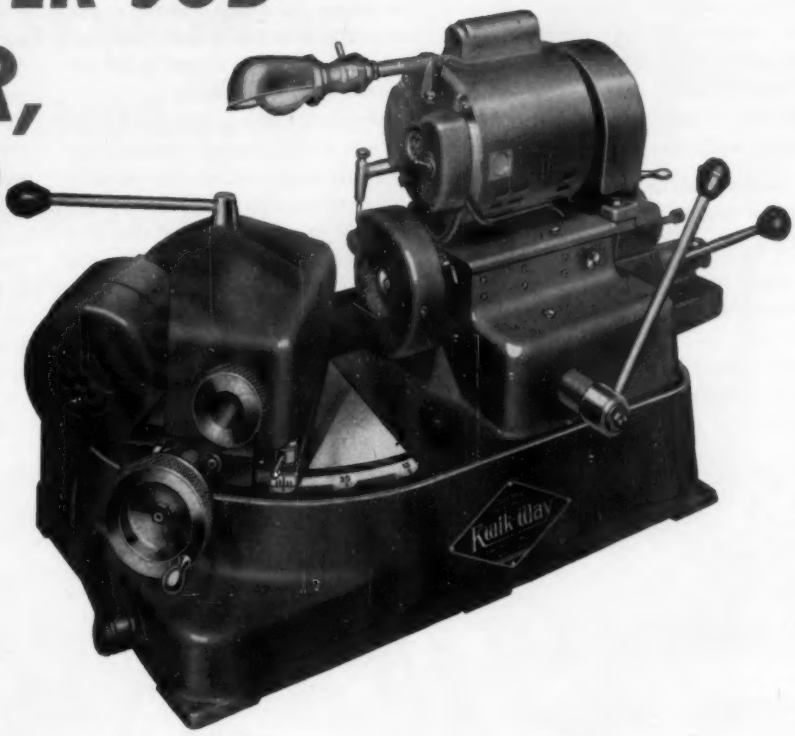
JOHNSON BRONZE COMPANY • 470 South Mill Street, New Castle, Pa.

JOHNSON JB BEARINGS
Sleeve-Type

Count on Johnson

A BETTER JOB FASTER, EASIER

with the NEW KWIK-WAY *Super-Matic* Valve Facing Machine



This outstanding new valve facing machine makes it easy to obtain extreme accuracy and superior finish, with smooth, simplified operation. For better valve facing work, the answer is Kwik-Way's Super-Matic.

- extreme accuracy
- superior finish
- smooth, easy operation
- Micro-switch operating controls
- precision built, lever operated, 6-ball compound chuck
- chuck capacity 7/32" to 5/8"
- improved coolant system
- extra power with dual motors
- dove-tailed, handscraped ways with adjustable gib
- pre-lubricated, sealed bearings on grinder spindle
- rugged construction. Built to highest standards for fine machine tools.

See and operate the Super-Matic in your shop. No obligation.
Call your Kwik-Way representative for a free demonstration.

MAIL THIS COUPON TODAY

Kwik-Way

Serving the Motor Rebuilding Industry Since 1920

VALVE FACING MACHINES • VALVE SEAT GRINDERS • VALVE SEAT INSERT TOOLS • VORTEX SUCTION DEVICE CYLINDER BORING MACHINES • LINE BORING MACHINES • PISTON CAM TURNING AND GRINDING MACHINES.

CEDAR RAPIDS ENGINEERING CO.
918 17th St., N.E., Cedar Rapids, Iowa

Tell me more about this remarkable new valve facing machine.

☐ Send literature.
☐ Have your representative come in and demonstrate the Super-Matic--at no cost or obligation.

Name_____

Company_____

Street_____

City_____ State_____

"Saves thousands of dollars and tons of weight"

Professional problem for Budd Company engineers designing the Budd RDC rail car was getting smooth, shock-free power transmission in a Diesel-driven unit that would increase railroad passenger traffic and revenue.

Low-cost solution was lightweight Allison TORQMATIC DRIVES.

The Budd Company reports, "That engineering decision saved us several thousands of dollars and 7,000 pounds per rail car." The TORQMATIC Converter-Transmission teams have proved their reliability in millions of miles of service.

The Boston and Maine Railroad — who will soon have 64 RDC's in its fleet — expects from experience to save $1,700,000 per year with the new units.

Passengers flocking to ride Budd RDC rail cars on 21 different railroads are pleasantly conscious of the infinitely smooth starts, silken acceleration, and up to 90 m.p.h. top speeds that give them faster, more comfortable commuting.

While railroad executives beam when they see their savings—two roads report Budd RDC's cut their out-of-pocket operating costs in half compared to the equipment the rail cars replaced.

If you'd build or buy better equipment, investigate Allison TORQMATIC DRIVES. You'll cut costs all along the drive line—get smooth shock-free power transmission in compact units proved on thousands of tough jobs.

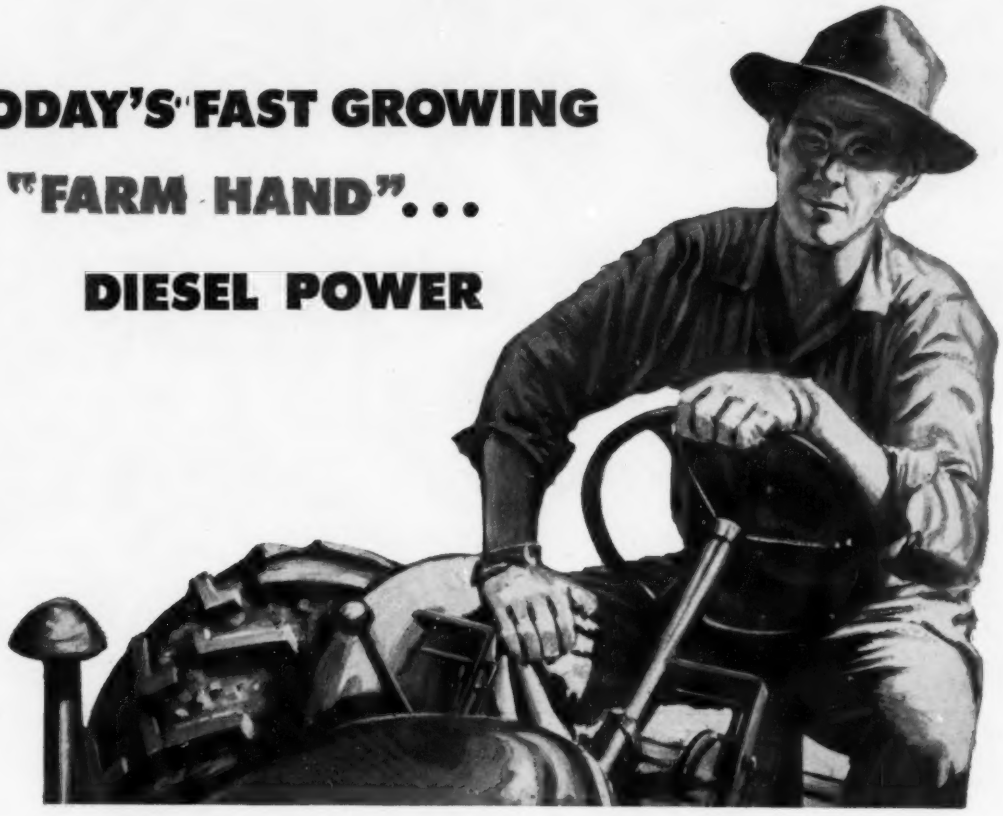
You can get Allison TORQMATIC Converters for gasoline or Diesel engines from 40 to 400 horsepower—TORQMATIC Transmissions to handle up to 300 h.p. Ask your equipment dealer or manufacturer about Allison TORQMATIC DRIVES next time you buy or write direct for more information.

Allison Division of General Motors,
Box 894S, Indianapolis 6, Indiana

GM
TORQMATIC

Allison
TORQMATIC DRIVES

TODAY'S FAST GROWING "FARM HAND"... DIESEL POWER



In ever-increasing numbers, farmers are turning to Diesel power—for tractors, combines and other types of farm equipment. A majority of these farm Diesels, with their great labor-saving and money-saving advantages, are equipped with American Bosch fuel injection systems.

The pump that helped make this impressive swing to Diesels possible was the American Bosch PSB. This simplified single-plunger injection pump gave Diesel manufacturers the pump they needed to produce the smaller lower-cost Diesels that are making such a mark in the farm equipment, and other fields.

American Bosch now has produced over 100,000 PSB's in just the few years since it was introduced. During this time, the PSB has achieved a remarkable record for performance and dependability under the most severe operating conditions. American Bosch, Springfield 7, Massachusetts.

3292

AMERICAN BOSCH

Division of
American Bosch Arma Corporation

Here are some of the farm equipment manufacturers who rely on American Bosch Diesel Fuel Injection Equipment:

Allis-Chalmers
Case
Cockshutt
John Deere
International Harvester
Massey-Harris
Minneapolis-Moline
Oliver

The towboat, *Crane*, is shown pushing loaded coal barges into the Ohio River at Pittsburgh on the way to Ohio Valley Electric Company's Kyger Creek Power Plant. St. Louis Shipbuilding Company built the *Crane* and sister ships, *Mike Creditor* and *A. L. Long*.

Ohio River Company calls for more when

Baldwin Diesel power proves efficient on M/V "A. H. Crane"

Performance of twin Baldwin Diesels on their M/V *A. H. Crane* showed Ohio River Company that Baldwin Diesel power is efficient, dependable, economical. They came back for more. Now the *Crane's* Baldwins are duplicated on the *Mike Creditor* (commissioned in February) and the *A. L. Long* (commissioned in June).

The *Crane* easily handles tows equivalent to 360 fifty-ton railroad coal cars (twenty 1000-ton barges) at a minimum fuel cost. Maintenance has been no problem at all.

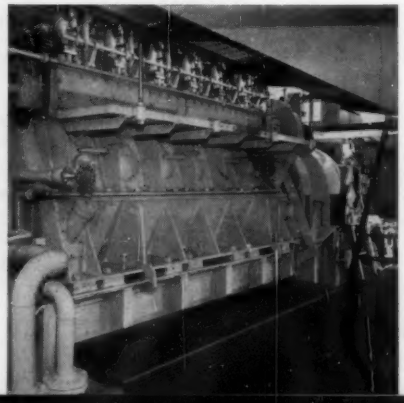
Find out how *you* can tow more, spend less with Baldwin Diesel power. Write us today for complete details!

BALDWIN · BLH · LIMA-HAMILTON

Hamilton Division • Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

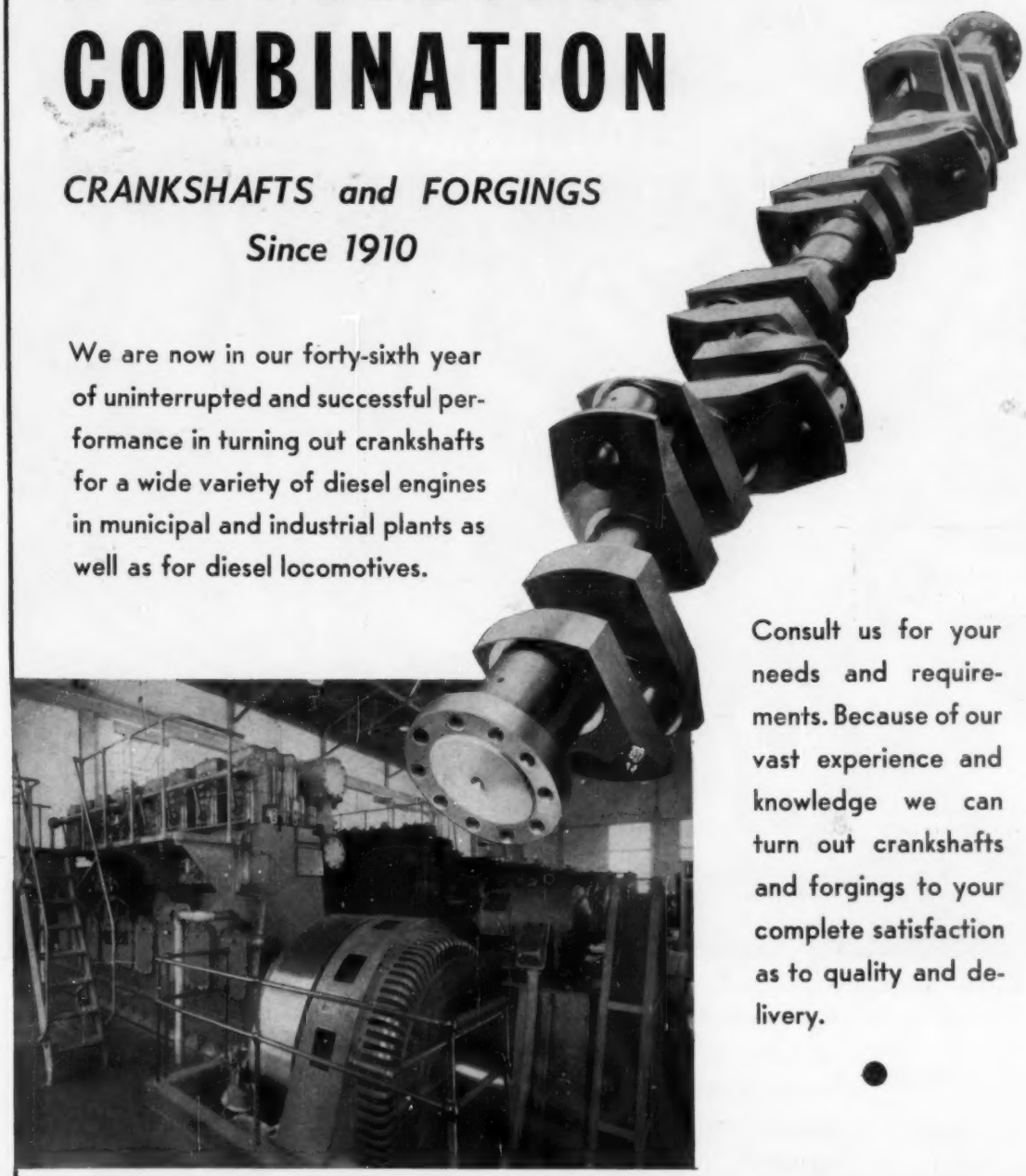
The *Crane's* two 6-cylinder, 4-cycle, 12¾ x 15½ turbocharged Baldwin Diesels each develop 1080 hp at 625 rpm. Their low weight per horsepower, rugged construction and high efficiency over a wide range of output make possible constant peak performance at low operating cost with minimum maintenance.



A SUCCESSFUL COMBINATION

CRANKSHAFTS and FORGINGS
Since 1910

We are now in our forty-sixth year of uninterrupted and successful performance in turning out crankshafts for a wide variety of diesel engines in municipal and industrial plants as well as for diesel locomotives.



Consult us for your needs and requirements. Because of our vast experience and knowledge we can turn out crankshafts and forgings to your complete satisfaction as to quality and delivery.

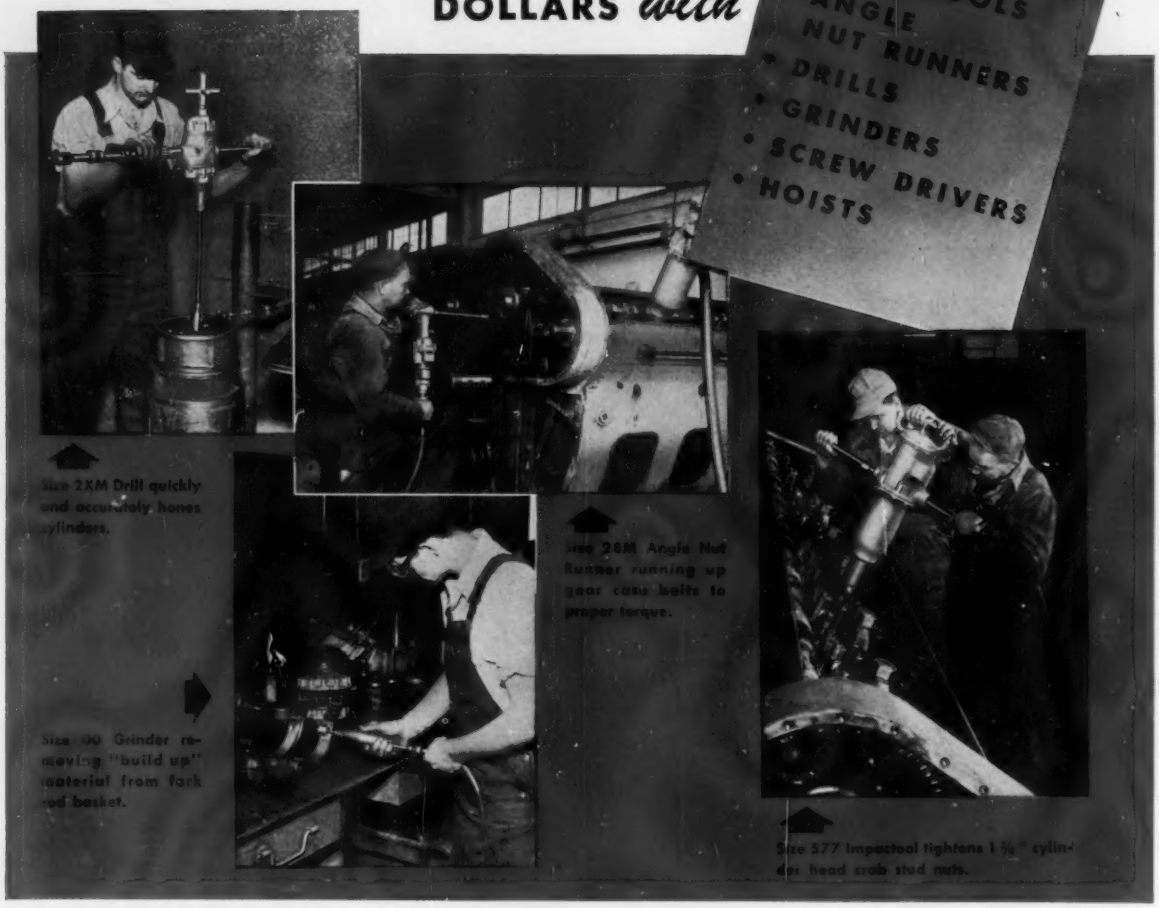
ELLWOOD CITY FORGE COMPANY
CRANKSHAFTS • CONNECTING RODS • MACHINE FORGINGS
ELLWOOD CITY, PENNA.

AIR TOOLS

FOR DIESEL MAINTENANCE

Save TIME AND DOLLARS *with*

- IMPACTOOLS
- ANGLE NUT RUNNERS
- DRILLS
- GRINDERS
- SCREW DRIVERS
- HOISTS



Size 2XM Drill quickly and accurately hones cylinders.

Size 28M Angle Nut Runner running up gear case bolts to proper torque.

Size 00 Grinder removing "build up" material from fork rod basket.

Size 577 Impactool tightens 1 ⅛" cylinder head crab stud nuts.

● Powerful Ingersoll-Rand Air Tools save dollars on diesel maintenance by saving time and manpower wherever they are used. A complete line of sturdy, dependable Air Tools is available to handle a wide variety of diesel maintenance jobs. Contact your nearest Ingersoll-Rand branch office; an I-R Air Tool Specialist will be glad to work with you in determining where Air Tools can save you time and money in your diesel shops.

Ingersoll-Rand

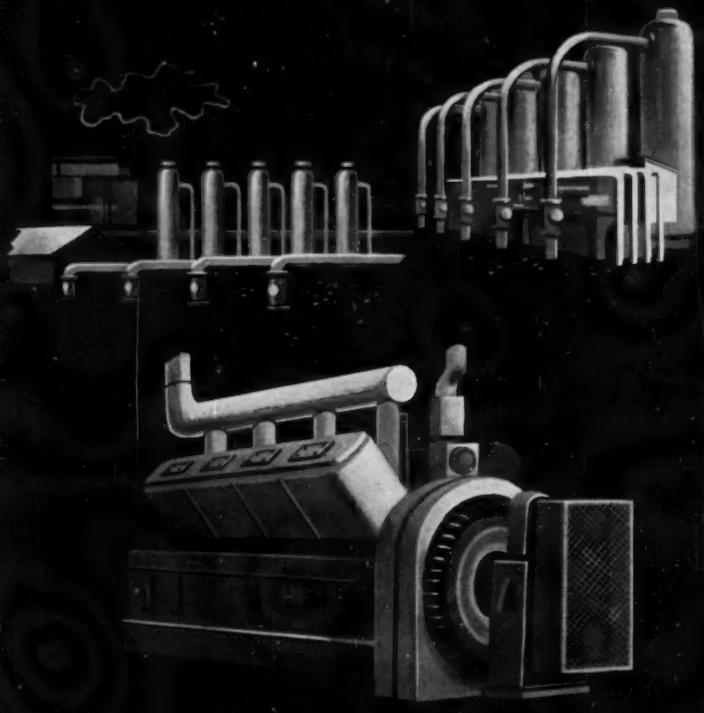
11 BROADWAY, NEW YORK 4, N. Y.

702-B

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

BEARINGS...

A Control Factor in Performance!



RESEARCH • DESIGN • METALLURGY • PRECISION MANUFACTURING

One of our biggest product transportation systems is seldom seen . . . because it lies below the surface. Countless miles of pipelines carry gases and fluids to every corner of the country. Gas, gasoline and diesel engines are the muscles that power the pumping and delivery systems. Our contribution to this day-in, day-out operation is the manufacture of quality bearings for engine dependability. We are a supplier to America's builders of industrial engines. **FEDERAL-MOGUL DIVISION,** Federal-Mogul-Bower Bearings, Inc., Detroit 13, Michigan.

FEDERAL-MOGUL
DIVISION

SINCE 1899

SENSATIONAL MILEAGE

STOPS! RING GROOVE WEAR

Double Bonded

METALLURGICALLY Al-Fin Bond

MECHANICALLY Zollner Lock

ZOLLNER

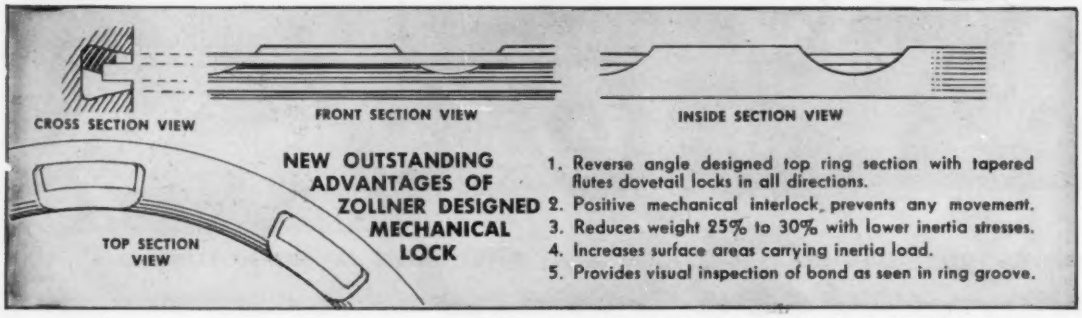
"Ni-Resist" Iron Top Ring Section

BOND LOC*

For Extra Heavy Duty Service

PISTONS

Up to 5 times more mileage is typical of this great new piston development by Zollner engineers. Designed for the most severe service, the BOND-O-LOC Piston has a "Ni-resist" iron top ring groove section *permanently* incorporated by *both* Al-Fin metallurgic bond and the exclusive Zollner mechanical lock. Separation failure is impossible. Reverse angles on every surface joining the "Ni-resist" iron section provide a multiple dovetail bond which is infinitely wedge-locked. Ring groove wear problems are eliminated, blow-by prevented, oil consumption reduced, mileage between overhauls greatly increased. Many heavy duty engine builders have already tested and approved BOND-O-LOC advantages. Request complete information, now.



NEW OUTSTANDING ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK

1. Reverse angle designed top ring section with tapered flutes dovetail locks in all directions.
2. Positive mechanical interlock, prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.
5. Provides visual inspection of bond as seen in ring groove.

Licensed under Patents 2,396,730; 2,455,457; 2,550,879 * T. M. Reg. Pat. App. For

- ADVANCED ENGINEERING
- PRECISION PRODUCTION

in cooperation with engine builders

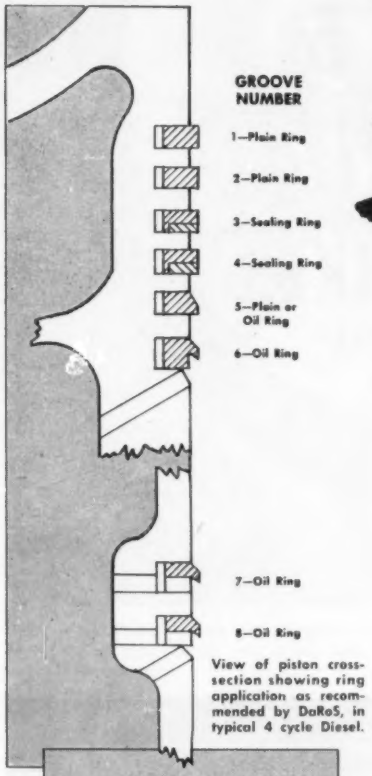
ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

ZOLLNER MACHINE WORKS • Fort Wayne, Indiana

SAVE FUEL...
up to 15% with DaRoS Piston Rings



View of piston cross-section showing ring application as recommended by DaRoS, in typical 4 cycle Diesel.

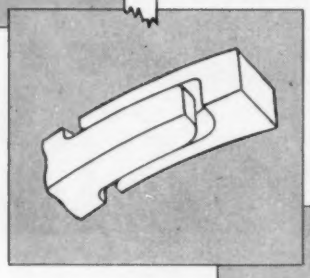
Here Are the Three Basic Reasons Why Users of DaRoS Rings Save 10% to 15% on Fuel!

1. DaRoS Rings do *not* leak—there's no blowby—no compression leakage—no loss of efficiency when you use DaRoS leakproof Sealing Rings. They successfully seal—in both new and worn cylinders. Typical DaRoS application on left shows how you can reduce compression loss—increase efficiency—save fuel up to 15%.

2. DaRoS Rings—made of Swedish Charcoal Iron—out-wear others—have a lower rate-of-wear—50% to 90% on rings and cylinders!

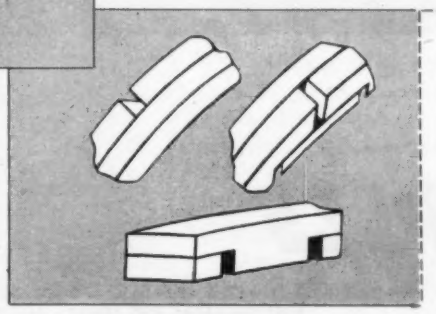
3. DaRoS Rings are made by Davy Robertsons Maskinfabrik — the world's first manufacturer of commercial piston rings. DaRoS furnishes original factory equipment to many of the leading engine builders. Over 50% of all of the motorships (above 1000 ton capacity) throughout the entire world are fitted with DaRoS Piston Rings.

Reduce your fuel costs NOW by installing DaRoS Rings in all of your engines —wire—write or phone for prices.



IMMEDIATE DELIVERY

... from Chicago on popular sizes for Industrial Engines



ABOVE. View of DaRoS ONE-PIECE Sealing Ring #201 recommended for new cylinders. RIGHT. View of DaRoS TWO-PIECE Sealing Ring #206 recommended for worn cylinders. *(This is another ad in a series designed to tell Diesel Operators the important story about DaRoS Swedish Iron Piston Rings.)*

DaRoS AMERICAN CORPORATION

D. D. COOK, President

8128 N. Lawndale Avenue
Skokie (Suburb of Chicago), Illinois U.S.A.
Distributors for North, Central and South America

DaRoS American Corporation
8128 N. Lawndale Ave., Skokie, Illinois
Gentlemen: Send me complete information on DaRoS Rings.

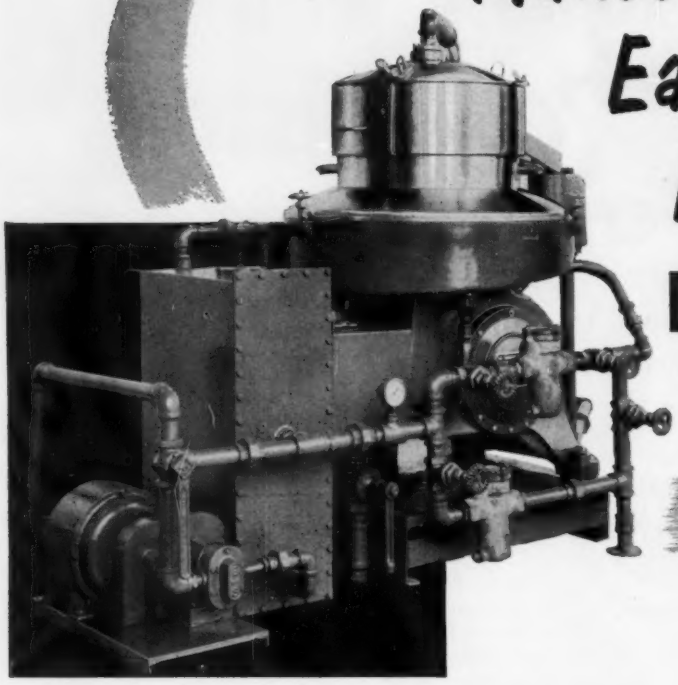
NAME_____

FIRM NAME_____

STREET ADDRESS_____

CITY_____ STATE_____

Sharples Makes It Easy To Purify BUNKER "C"



If you want to see the eye-opening facts of the great savings that result when a Sharples conditions low cost residuals for diesel fuel—write today.

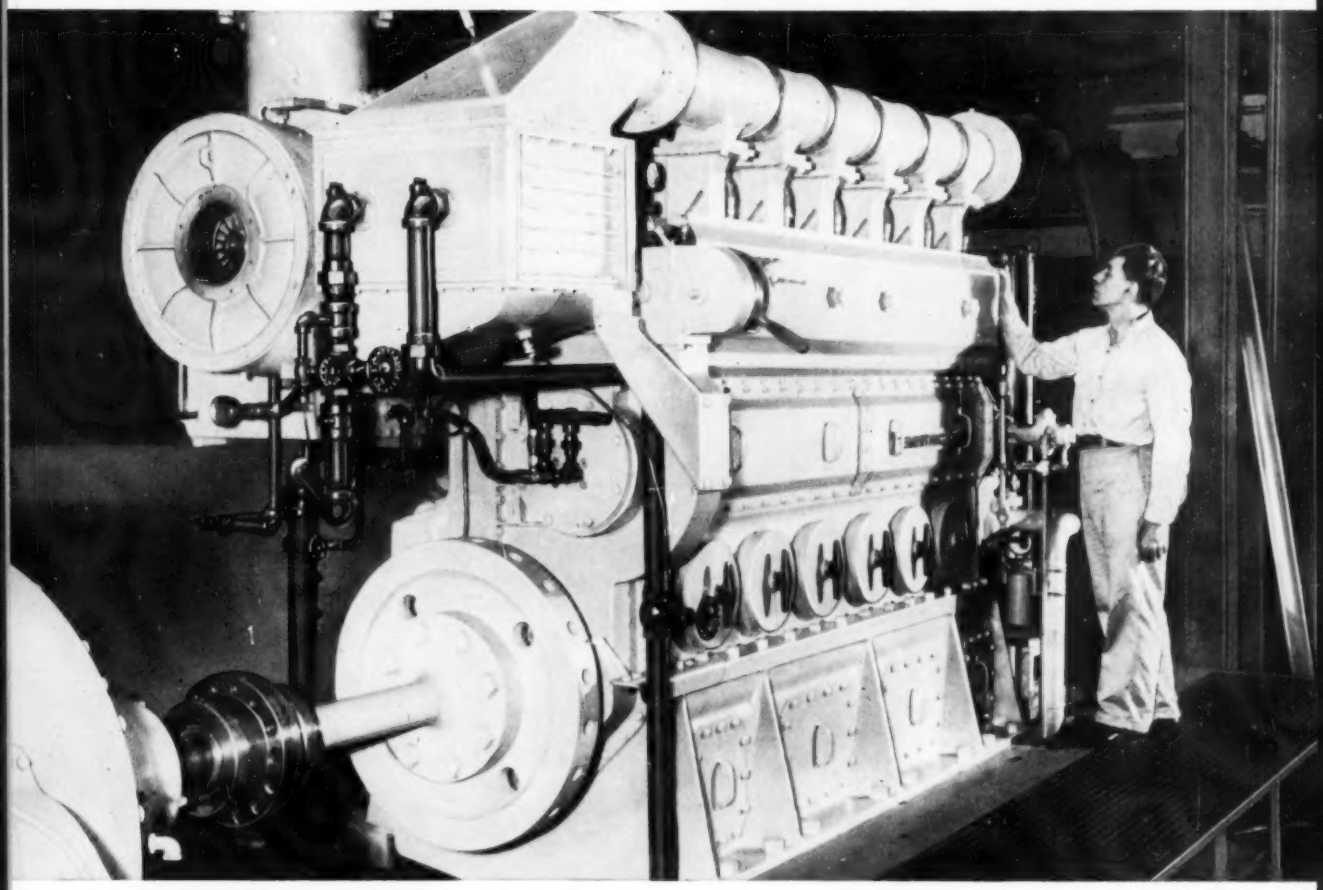
The Sharples residual oil purification system is a complete unit that is self-flushing—so the old bowl cleaning headache is a thing of the past.

Add this cost saving feature to high capacity, efficient removal of the unburnables from "bunker C" oils—and you have an investment that will pay for itself in a few short months.

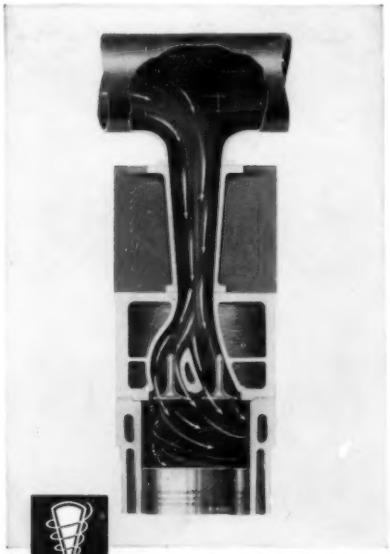
SHARPLES

THE SHARPLES CORPORATION
2300 WESTMORELAND STREET • PHILADELPHIA 40, PENNSYLVANIA
NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON
Associated Companies and Representatives throughout the World

WORTHINGTON ANNOUNCES



NEW W9 ENGINE. Available as straight Diesel, dual-fuel, or spark-ignition gas engine, with or without turbocharging.



JET-SWIRL POWER

FOR HIGH OUTPUT EFFICIENCY. Aerodynamically perfect passage gives minimum flow resistance. Directional baffle imparts swirling motion to air entering cylinder for perfect combustion fuel-air mixture.

new, heavy-duty 400-1400-hp W9 engine

for continuous service

The new Worthington W9 engine is designed and built for minimum possible weight consistent with heavy-duty service.

It's a true, continuous heavy-duty engine, yet compact enough for portable, semi-portable, standby or emergency and marine power service. A welded steel base makes it easy to adapt to existing foundations, trailer or railroad-car frames, or drilling rig structures.

What's more, the W9 features the newly developed Worthington Jet-Swirl air intake (*left*) that produces controlled turbulence in the cylinders for best mixture of fuel and air for fuel economy. Streamlined passages and directional baffles between double intake valves give the incoming air a swirling motion that ensures fast, complete fuel-air mixture.

Available as a straight oil Diesel, dual-fuel Diesel or spark-ignition gas engine, in four basic sizes, with or without turbocharging. Nominal speed: 900 - 1000 rpm.

TURN PAGE FOR MORE FACTS

Here's what the NEW WORTHINGTON W9 ENGINE gives you-

Check these features

1 ***Jet-swirl air intake passages*** give maximum air turbulence for complete fuel-air mixture and best fuel economy.

2 ***Massive crankshaft***

3 ***Hydraulic valve lifters*** eliminate clearance adjustments, give quiet, efficient operation.

4 ***Cast-in-cylinder water jacket*** eliminates sealing rings between crankcase and water jacket — eliminates possibility of lube oil contamination.

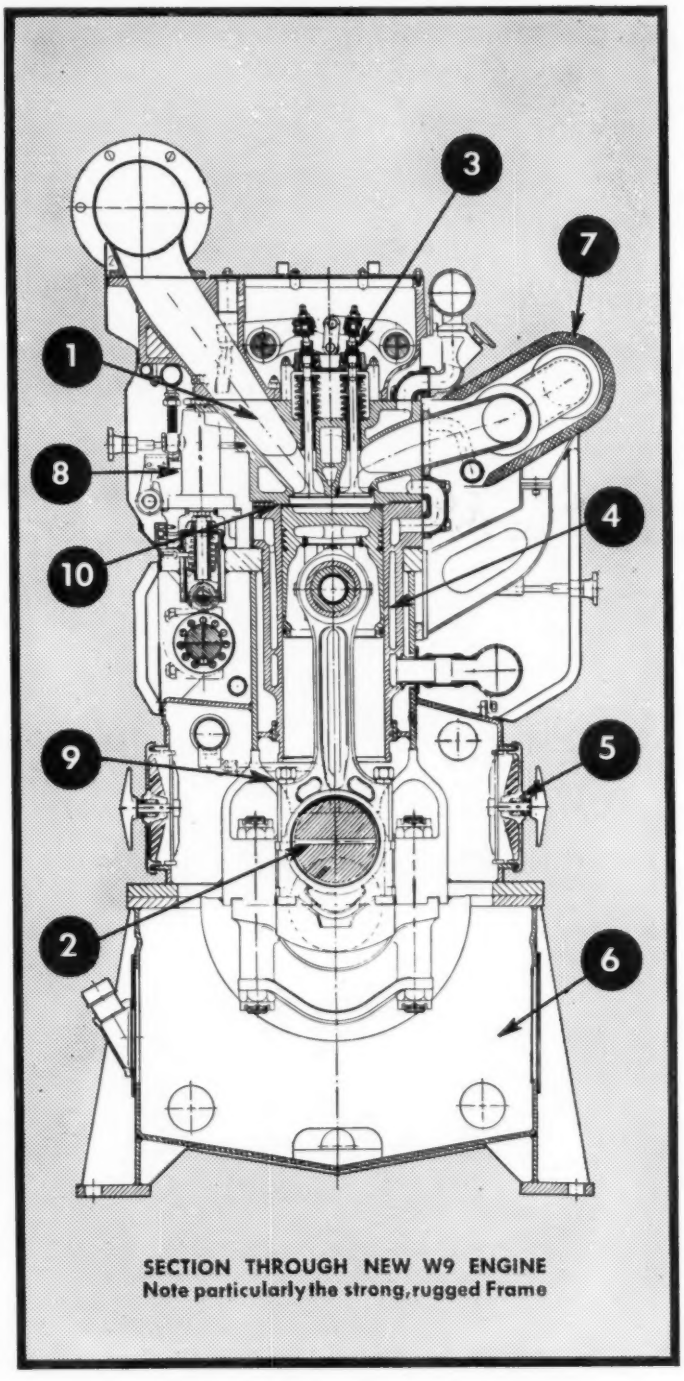
5 ***Large, easily removed inspection doors*** make maintenance easy and do double duty as spring-loaded pressure relief covers.

6 ***Welded steel base*** can be mounted on flat surface or made to suit any existing structure — provides maximum strength with minimum weight.

7 ***Dry insulated exhaust manifold*** reduces cooling water requirement — provides extra energy to turbochargers.

Of course, the new W9 engines have the same features found on larger Worthington engines: separate fuel pumps (8) for each cylinder, four-bolt connecting rods (9) and head design (10) that eliminates need for gaskets.

Get the whole story on the new Worthington W9 engine. Write Worthington Corporation, Section E.5.8, Harrison, New Jersey.

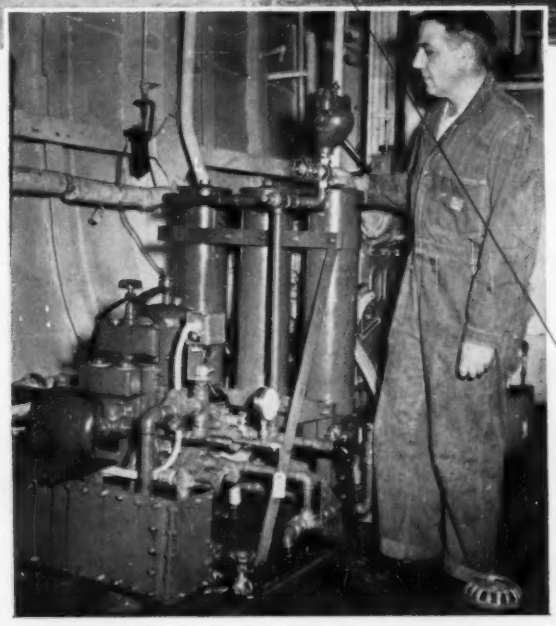


SECTION THROUGH NEW W9 ENGINE
Note particularly the strong, rugged Frame

WORTHINGTON

Economical, Continuous Power — *Diesel, Dual-Fuel and Spark-Ignition Engines, from 150 to 5,000 bhp*

NO MAJOR ENGINE REPAIRS IN OVER 2 YEARS' SERVICE ...THANKS TO DE LAVAL "PURI-FILTERS"!



The Shipowners & Merchants Towboat Co., Ltd. of San Francisco (Red Stack Line) has two sea-going diesel engine tugs on which De Laval "Puri-Filters" have been in service for over two years.

Now Mr. Jos. M. O'Leary, Port Engineer, reports:

> "The 'Puri-Filters' are operated around the clock—twelve hours on one engine and twelve on the other. Engines have been opened for inspection and found to be very clean . . . no sludge on walls, rings free, ports clear. Oil consumption has decreased . . . *and in over two years no major engine repairs have been required.*"

This is a typical example of De Laval "Puri-Filter" service. There simply is no better, safer way to keep diesel lube oil both *clean* and *dry*—as proved by the experience of hundreds of diesel-powered generating stations and vessels. Get *all* the facts—write today for the new De Laval "Puri-Filter" Bulletin.

DE LAVAL
lubricating oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

cut your diesel maintenance costs with

PUROLATOR

in these three spots

Even the cleanest fuel supply brings damaging dust, dirt and grit into your diesel engine. Without filtration, injection pumps gall, wear and lose their accuracy. Nozzles get plugged and burn. Even if your engine goes on running, the power output of individual cylinders goes badly out of balance.

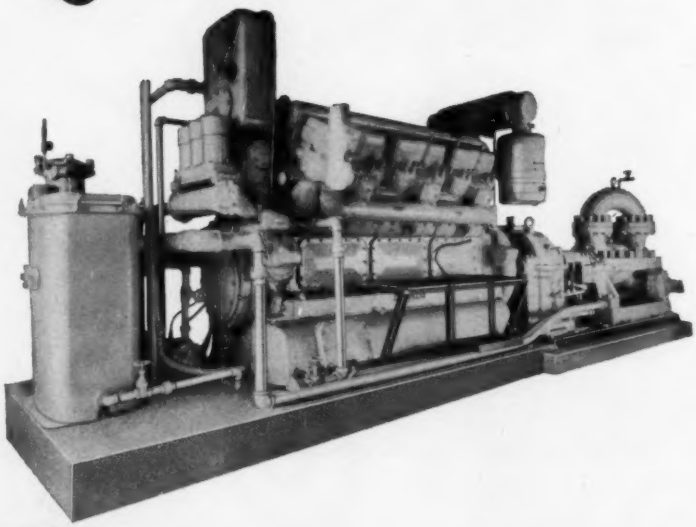
So . . . effective fuel oil filtration is absolutely essential. For your engine to keep running at peak efficiency and with minimum outlay for maintenance, its fuel system should be equipped with PUROLATORS in the three areas listed at the right.

For details of the PUROLATOR models designed for use in these diesel applications, write today for the PUROLATOR diesel catalog. Address Purolator Products, Inc., Rahway, N. J., Dept. DP1-1011

Immediately before and after the transfer pump. The PUROLATOR on the suction side protects the pump. The one on the pressure side takes out any bits of metal worn from the moving pump parts.

In the fuel line before the injection pump. A PUROLATOR here is an inexpensive way to assure smooth, wear-free operation of the injection pump.

Built into each injection nozzle. While there is no obvious source of contamination beyond the injection pump, experience shows that an individual metal-edge filter element built into each nozzle assembly vastly improves nozzle life expectancy.



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Delco-Remy A.C. generators with companion regulators and rectifiers are the hearts of 12-volt A.C.-D.C. electrical systems designed specifically for modern Diesel buses with fluorescent lighting and extra-heavy electrical loads.

Desirable performance characteristics include cut-in at low generator rpm . . . maximum outputs (ranging up to 180 amperes) at low to medium speeds. The new generators supply not only alternating current for fluorescent lights but also ample direct current for the heaviest electrical loads coupled with lengthy engine-at-idle periods.

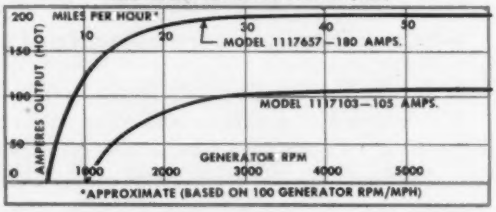
Impressive features of the new generators are their light weight, very high output capacity, and ability to operate over a wide speed range with greatest efficiency. Specify Delco-Remy electrical equipment on your new buses.

A.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes*	Maximum Amperes	Power Watts SAE	Recommended For
1117103	12	960	5	105	1575	All speeds.
1117657	12	550	130	180	2700	All speeds.
1117062-3-4	6	750	38	90	720	All speeds.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

A.C. GENERATOR OUTPUT CURVES (HOT)



*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

DELCO-REMY HEAVY-DUTY D.C. SPLIT-FIELD GENERATOR (120-Ampere Output Capacity)

The Delco-Remy 12-volt split-field generator and its companion regulator are rugged and dependable—designed to meet the needs of Diesel transit buses having increased electrical loads coupled with a high percentage of engine idling time.

Desirable performance characteristics include low cut-in, maximum output at less than 1,000 generator rpm. Note performance table at right.

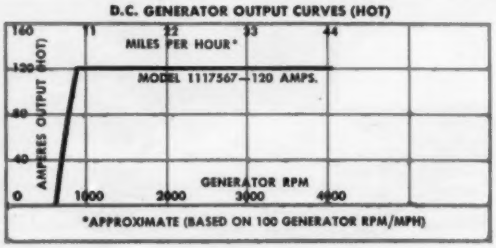
Operating benefits include reduced battery cycling, long battery life, and a simplified electrical system with sustained voltage—at no sacrifice in ruggedness or dependability.

D.C. GENERATOR PERFORMANCE DATA (HOT)

Model	Volts	Cut-In RPM	Curb Idle Amperes*	Maximum Amperes	Power Watts SAE	Recommended For
1117567	12	560	120	120	1800	Low speed & idling.

*APPROXIMATE (BASED ON 1000 GENERATOR RPM)

D.C. GENERATOR OUTPUT CURVES (HOT)



*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

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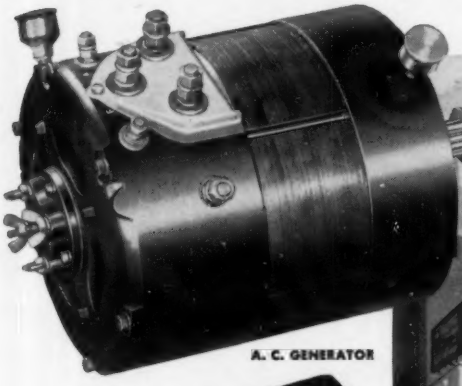
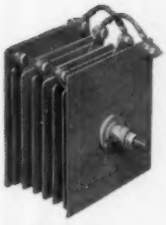
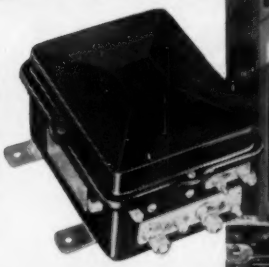
right for the job



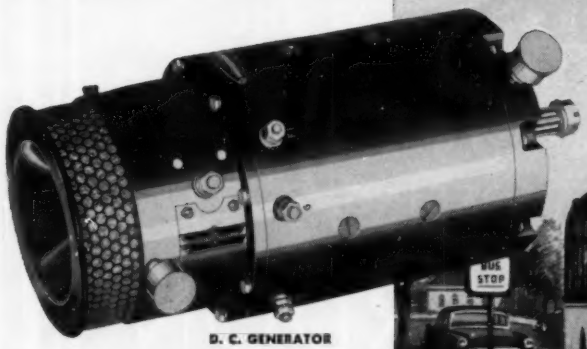
A. C. GENERATOR



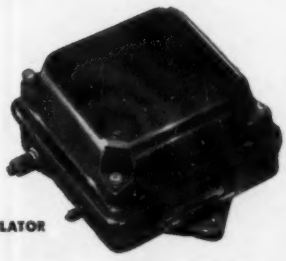
RECTIFIER



REGULATOR

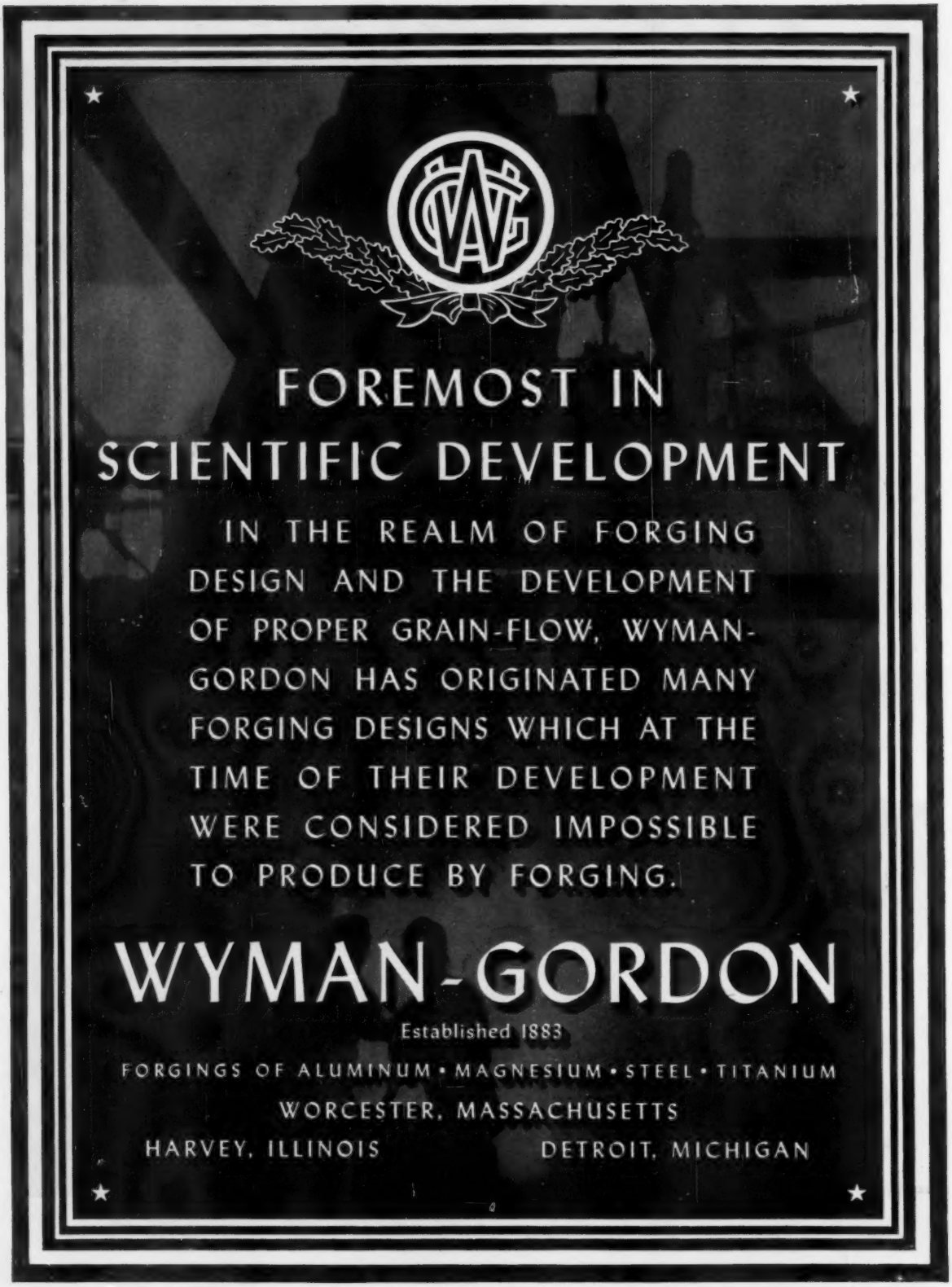


D. C. GENERATOR



REGULATOR

WHEREVER WHEELS TURN OR PROPELLERS SPIN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SCIENTIFIC DEVELOPMENT
IN THE REALM OF FORGING DESIGN AND THE DEVELOPMENT OF PROPER GRAIN-FLOW, WYMAN-GORDON HAS ORIGINATED MANY FORGING DESIGNS WHICH AT THE TIME OF THEIR DEVELOPMENT WERE CONSIDERED IMPOSSIBLE TO PRODUCE BY FORGING.
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Design for Maintenance

Next time you have a major repair job to do, make like a time-study man. You'll find that certain non-related parts will be removed, that you'll need a special tool here and there, and before you're done, you'll be convinced that the designer had some outer-space people with four double-jointed arms in mind when he laid the thing out. There is certainly enough of this sort of thing around to be irritating and the basis of a standing joke. It's no joke, brother; it's costing you money. And you pay for it twice! In one reported case, a hydraulic pump and counterweight on a front-end loader had to be removed to . . . change the engine? . . . no, to change a fan belt! Cost—three to four hours mechanic's pay *plus downtime.* Your own time study will confirm (if you need convincing) that a high percentage of job time is used in necessary but incidental work. Why is this so? Two major reasons are physical limitations and costs. So often a machine starts out fairly "clean", but as improvements and modifications are added, the unity of overall planning is lost and accessibility often suffers. It's easy for a builder to work himself into this box, and the alternative, redesign, can cost money. "Ease of maintenance" features are worth the cost; as a competitive feature to the builder, and a money-saver to you. There's a lot being done along these lines. One spark plug is the Corps of Engineers labs at Ft. Belvoir. While aiming at easy maintenance of military equipment, their studies are already affecting commercial designs. Hydraulic track adjusters for crawlers are one example. The SAE is also active in this field. They set up a sub-committee to function as a hub of a co-ordinated activity aimed at investigating and evaluating ease of maintenance practices and principles. We're hoping for great things as all this work progresses. Meanwhile, see what you can work out to help yourself. And let us know; we'll pass it along.

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highlights

- **Alcoa has developed a new alloy said to offer excellent properties at 500°F to 600°F, a valuable range for automotive engines. The high temperature alloy is now available in experimental quantities.**

- **At least one-half of new electric generating stations built in 1980 will be atomic powered, says S. B. Roboff, Sylvania scientist. As for transportation, he thinks that except for military use, nuclear power will be limited to ocean vessels for many years to come.**

- Curtain raiser to the American Trucking Assn.'s 22nd annual convention will be the national Truck Roadeo in Washington, Oct. 13 to 17.

- The final shift from steam locomotives to complete dieselization was celebrated by the nation's third oldest railroad, the Long Island, on Oct. 8th.

- Argentina has approved a contract with Baldwin-Lima-Hamilton for 50 diesel locomotives, estimated to be worth near $10 million.

- Natural gas is America's fastest growing primary fuel, according to H. C. Barten of Worthington. Since World War II, an average of 15,000 pipeline miles were laid each year and today the industry is the largest single source of business for stationary engines.

- The complete rules and regulations of the Federal Power Commission will be available in a set of five pamphlets early this winter.

- Socony Mobil Oil has made public an intensive survey regarding the effect of imported residual fuel on the domestic coal market. Bituminous coal losses, it found, were to competitive fuels—distillates, residual, and gas. If the coal industry recaptured markets lost to residuals since 1939-40, production gain would be only 2% at most. Incidentally, Socony imports no residual fuel affecting the U. S. market.

- Nordberg recently received an order for 15 gas engines from the Houston Texas Gas and Oil Corporation. These engines, rated 3500 hp each, will serve on a gas transmission line which will be constructed between Louisiana and Florida.

- A leading farm tractor manufacturer reports that in the Nebraska area, 60% to 70% of the wheel-type tractors sold during the past three to four years have been diesel powered.

- The first attempt to survey the entire American oil industry has been undertaken at Northwestern University under API grant. A 2-vol history will be the end result, expected to be off the presses in 1959.

- Willys Motors has abandoned pleasure car manufacture to concentrate on workhorses for the services, all of which are being built on the basic jeep frame. They're also experimenting with a diesel jeep.

- GM tells us, "The U.S. Navy is the largest user of diesel engines. There are more 16-cyl, 200-hp engines installed by Cleveland Diesel Engine Division of General Motors in the Navy than any other type."

- **Philadelphia is considering a program for modernizing its rolling stock. Approval will allow purchase of 700 diesel buses to supplement an earlier program for 300 new buses which are currently being placed in service.**

- **F-M has engineered the control system for a concrete mixing plant which requires no manual labor at any point in the process. Cleveland Builders Supply Co. is using the plant which turns out ready-mix by punched cards and electronic controls under any one of some 1500 mixing formulas. Belt conveyors carry the material to storage bins where electronic controls direct them to the mixer as needed.**

Insufficient valve lash, sticking, distorted valve seat, or anything causing leakage, overheats valve resulting in face failure.

Why Did That

Failed valves can tell you their story if you know their "language". Here's the data needed for proper interpretation.

LET'S face it; some valves fail prematurely. However, the fact that the majority of them live to grow old gracefully, strongly suggests that there are reasons for short service life. It is not enough to just replace the valves; you must find out why they failed or face the prospect of a repeat performance.

Tracking down troubles may be very difficult because there is generally only a small amount of evidence available. It would be nice if each trouble had a clearcut and characteristic result; locating troubles would be a cinch. Unfortunately, this is not the case. One trouble may lead to another or show similar symptoms. In extreme cases, failure may be so complete as to destroy all guiding evidence.

It is fundamental to the overall problem to understand why and how valve failures occur. This is your best chance of detecting the cause of failure or, better yet, correcting the operational and maintenance lapses that cause them. Prevention is better than cure.

My purpose is to discuss some of the basic principles to provide a sound background for the analysis and solution of valve problems at either the preventive or curative stage. You don't have to know how to design a camshaft, for example, but you should know the underlying principles of what a camshaft is supposed to do and why certain factors are important to obtain satisfactory valve life.

Look at the accompanying chart. Like any chart, it is necessarily simplified but it shows the pattern of failures and the more important causes. These will be amplified in the text. Note that the end result—valve failure—falls into two general categories:

Face Failures—causing leakage and performance loss.

Breakage—causing complete functional failure. In most cases, high temperatures, mechanical irregularities, or a combination of the two are the principle culprits. Operation—mainly overloading and overspeeding—can also be a contributing factor.

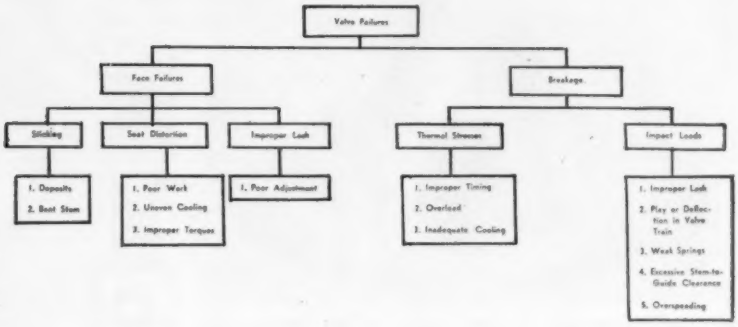
Face Failures

Operation at excessive temperatures leads to face failure. "Excessive temperatures" might be defined as those in excess of what the material can stand in the particular working environment. End result is loss of metal, generally from excessive corrosion, and/or cracking. The question is, "What caused the high temperature?"

Anything preventing the valve from seating properly

Hard shiny deposit on valve stem where it enters and leaves guide indicates valve sticking. Again overheating caused face failure.

Valve Fail?



by V. C. Young, Chief Engineer,
Valve Division, Eaton Manufacturing Company

will permit leakage and subsequent overheating. Several items cause leakage and end results are so similar that it is rather difficult to separate them.

One of the most common is lack of lash between the valve and rocker arm. Clearance must be maintained to permit expansion and contraction to take place without either holding the valve off its seat or permitting it to seat at excessive velocities. This sounds rather fundamental, but experience points to frequent neglect and emphasizes the need for continual repetition.

So-called "sticking" prevents proper valve seating. It doesn't have to be much; prevention of contact by just a few thousandths will do it. This is very difficult to pin down because in many cases the trouble is intermittent. When the engine is checked, no evidence may be found.

This type of sticking generally results from deposits building up at the port end on both the guide and stem. We contend that counterboring the guide, undercutting the valve, or both, is not the answer to eliminating these deposits. We feel that any "pocket" in this area provides a place for deposits to form and that they will eventually result in interferance.

We also think that guides should be cut flush with the boss and if boss cooling is poor, even up inside the boss. Theoretically, valve stems run cooler if protected by a shroud such as the guide extension. Practically, this extension becomes exceedingly hot, retains deposits, and causes incomplete seating. Granting these matters to be controversial, I am giving you my opinion based on examination of a great many failed pieces.

When tearing down an engine in which valve life has been short, examine the stems where they enter and leave the guides at the port end. If you find a hard and shiny deposit as illustrated, you can be pretty certain that under some condition of operation incipient sticking is occurring. The result is an overheated valve face.

All valve seats tend to distort. The type and extent of distortion is a product of many variables. On the design side these include the cylinder head, the inserts, cooling water flow, etc., and the object is to reduce the distortion to a minimum. Anything occurring in rebuilding, operation, or maintenance, that affects this distortion might exaggerate it, resulting in leakage and overheating.

When valves are reconditioned, it is extremely important that the seat be finished true with its guide. It is not necessarily the amount of runout that is important, but the type. A valve can accommodate itself to a certain amount of true eccentricity, but if there is ovality or chatter, nothing can be done to seat the valves properly.

We deliberately cut inserts to an oval shape with two opposite low areas (about 0.002-in) as part of an accelerated materials test of resistance to corrosion. This has accelerated face failure (everything else being equal) on the order of 6 to 1. You can see why we lay great stress on the importance of performing a very careful job on seats.

Even the best job can be offset by improper torquing. This includes the cylinder head studs, injector hold-down fastenings, manifold bolts, rocker arm supports, etc. Uneven and/or excessive tensions will promote distortion that eventually leads to early face failure.

Improper cooling is another adverse factor. Effect of excessive temperatures has been discussed but uneven temperatures are also harmful. Plugging and scaling of water tubes and passages, irregularities of devices intended to direct coolant flow, localized scaling or pockets of sediment, and even low water level or improper circulation are some possible troubles.

All valve seats tend to distort. Anything affecting distortion during operation or maintenance accelerates face failure as shown.

Heat cracks result from repeated overheating and cooling. Since blow-by, causing overheating is localized, cracks are localized.

When the heat cracks progress and join together, a pie-sector breaks off and it falls out of the valve head.

Even though face failures are hard to diagnose, some clues are available. Then by checking the possible causes and correcting the conditions found, there is reasonable assurance that you have eliminated the cause of premature failure. But don't jump to conclusions; analyze the problem.

Valve Breakage

There are two common types of valve breakage. Breakage of the head portion generally results from local leakages that cause heat checks. These checks propagate until two may join together and a pie-shaped sector breaks out of the head. A second type of breakage occurs at the neck or junction of the stem and under-head radius.

Seat face cracking of either faced or unfaced valves is generally the result of blowby. You can duplicate this failure on the bench by heating and cooling the seat face. We call it quench fatigue cracking. Repeated thermal overstressing is more than the material can take and cracks result. When blowby occurs, areas exposed to the gases overheat in the localized area of leakage.

Of course there is always the possibility of a defective piece, particularly with faced valves. This would be an isolated or random type of failure. Where chronic, we are pretty certain it is not due to faulty fabrication.

To illustrate, we had a hassle with an engine builder as to whether we furnished cracked valves or the engine cracked them. This valve did not turn and it was possible to line them up in operating position by referring to the rocker arm contact on the valve tip. All cracks were in the same relative position, indicating definite cylinder head distortion. A redesign of the head to provide better cooling eliminated the distortion of the seat, stopped leakage, and eliminated the cracking problem.

Seat face failure should be treated similarly to items mentioned concerning causes of face failure.

Neck breakage is caused by only one thing: seating impact loads too great for the material to stand. The higher the neck temperature, the lower its strength. But even hot valves should not break if they seat as intended by the designer.

Many factors can contribute to high seating velocities. If you keep the thought in mind that it must be high seating velocity and hence impact that breaks valves, you can dig in and uncover the real culprit. Here I would like to give you a little theory on cam design—not to make designers out of you but to help you visualize what goes on and why.

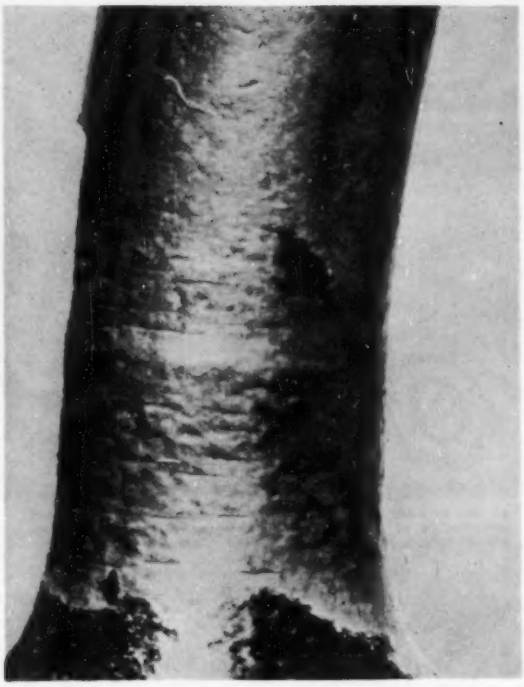
A cam's basic job is to open and close the valves at proper intervals. On its opening side is one curve whose rate of lift is relatively low for a given number of degrees of rotation. This is to make sure that the deflection in the valve gear is taken up before a high lift rate occurs and also to allow for the extremes in lash adjustment.

This curve is joined to one whose rate of lift increases quite rapidly to provide the proper opening. This rate of change of lift is termed "velocity". The valve gear is given its initial start with low velocity, then speeded up. After a certain period, this change of lift (or velocity) decreases. The point of deceleration is where the spring is needed to keep the parts from taking off and losing cam contact.

Deceleration continues until peak lift is obtained and the cam starts on its closing side. Again there is a period of acceleration with velocity building up in the opposite direction. Parts are again held together by their inertia. Near the point where the valve is seated, the rate of lift is changed again, decreasing it or providing a low velocity curve to take care of deflection and change in lash. The valve is eased onto its seat.

A factor often overlooked is the amount of deflection. You can now see that if the lash is set high and deflection in the valve gear more than normal, the valve can strike the seat when the tappet is riding the high-velocity portion of the cam. High impact loading results. Remember that loading from inertia varies as the square of the speed, and so the amount of deflection can be considerable at high speeds.

Getting back to lash again, wide extremes in engine operating temperatures can cause trouble. Sufficient lash for severe service with its high temperature conditions



Excessive lash, regardless of how it occurs, causes the valve to seat hard resulting in fatigue cracks in the over-stressed metal.

may permit high-impact seating when engine temperatures are low. The material of the neck is overstressed and fatigue cracks may develop.

With continued operation the cracks may progress to the point of breakage even with normal seating. It's tough to pin down these failures because of the time lag between cause and effect. Suppose that for some time before a check, the valves operated with more than normal lash. Fatigue cracks started. During maintenance the lash is reset. Some time later a valve head breaks off and since the lash is found to be normal, it is not blamed.

Another factor affecting seating load is excessive guide-to-stem clearance. Increase in this clearance allows the valve to tip, particularly if the spring is not square with its seat. This can have the same effect on seating loads as operating with excessive lash since the valve can contact the seat while riding the high-velocity portion of the cam.

Any overhead valve, pushrod-operated, has flexibility in the valve gear system and can be considered similar to a spring. When the cam starts to move the tappet, the valve does not immediately move, as all of the deflection of the various parts must be taken up. Combined weight of the parts and this flexibility determines its "frequency" or rate at which the whole system vibrates.

Like any spring it will vibrate when in operation. If a load is very rapidly applied, the amount, or amplitude, of this vibration can be very great. Anything that affects the deflection of the parts can affect this rate or frequency of vibration. Worn bushings or rocker arm shafts can change the motion and result in excessive vibration. Rocker arm supports should be properly tightened. So be sure and examine all parts.

Valve springs can also cause breakage. It is their function to keep the valve gear parts in contact with the cam when they want to fly off into space. A weak spring, for example, might allow the tappet to ride right off the nose of the cam. Then when spring tension does overcome the inertia, the valve can get a "free" fall or bounce on to its seat without the retarding influence of the decelerating portion of the cam.

All springs have a definite relationship between load and length. If the spring operates at greater than its designed length, its load is reduced. Springs always take some set but this is usually allowed for in the original design. During repair work, the installed length of the spring is important. This might have been increased by grinding the insert and valve face or surface grinding of the head involving deepening of the insert counterbores. The loss in load might be a factor in subsequent valve failures.

Springs should be square. You can check this by setting them on end on a surface plate and using a square. Some tolerance is allowable since it is very difficult to make springs that are absolutely square, particularly under load. If a few vary obviously from the majority, it is better to scrap them rather than to take a chance. The money you would save is nothing compared to the expense of an early valve job.

Springs should also be squarely installed. Check that ends are seated properly in counterbores, retainers, etc. If spacers are used, be sure that they are flat and the faces parallel.

Finally, engine overspeeding can lead to valve breakage. Forces involved in the valve gear increase as the square of the speed. This means that if the speed is doubled, the force is increased four times; and if speed is increased four times, force increases sixteen times. Most valve gears are designed to be safe at a certain rpm, and if this is exceeded by too great a margin, destructive forces are set up.

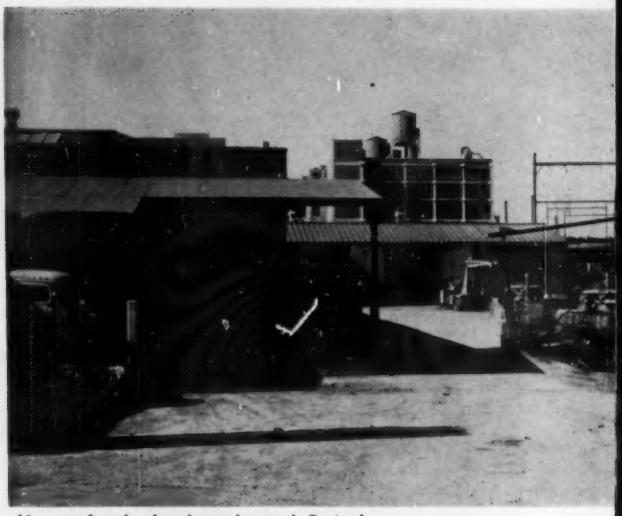
Conclusion

We now can see that there are many reasons for premature valve failures. Some of these lie within the province of the engine builder and/or the valve manufacturer. Their main job is to get a properly designed and soundly fabricated product into the hands of the user.

From that time on, valve life will depend to a great extent upon the engine's operational conditions and the quality of maintenance. These are matters under the control of the user. Now it's his problem.

I have tried to pass along some ideas that can be used as background in the diagnosis of valve troubles. By avoidance of the conditions leading to early valve failure, you can bypass a lot of trouble. If the troubles do occur, you have the basis for a careful and intelligent analysis of the causes. When you find and eliminate these, your troubles are over.

Main shop area at Giles and Ransome. Engine rebuilding section is in foreground. Overhead crane serves full length of this side of shop.



At rear of main shop is service yard. Parts department is at left. Shop extension in background houses cleaning and paint departments.

Talking Shops

Our "Talking Shops" program, started sometime back, is now getting into full swing. This time our visit is to Giles and Ransome Inc., the Caterpillar Tractor Co. Dealer at Philadelphia, Pennsylvania —Ed.

ALL diesel repair shops have the same objective—to fix diesels. But they are not all alike. Physical facilities, types of engines or equipment serviced, and the experience and ingenuity of the men responsible for servicing make the difference.

We are looking for the little "tricks-of-the-trade" these men use to shorten the amount of time necessary to service properly or rebuild an engine or accessory. These ideas, which most times include special tooling, are the things that may save you and your customer time and money.

We are going to talk to Mr. Otto Parkkonen, Service Manager for Giles & Ransome. Usually, the first item on our list is a trip through the shop. This is where the ideas for better service are actually at work. After a look at the shop, we will have a number of questions to ask also.

Walking out into the shop area, our first stop was the machine shop area where all component assemblies, are rebuilt. Included in this area are two other rooms; one is simply a wire enclosure in which all hydraulic components such as those found on heavy earthmoving equipment are repaired and tested; the other is a glassed-in room for injection equipment. In addition, the latter room handles the rebuilding of governors, water and oil pumps, fuel transfer pumps, and electrical equipment.

Directly to the rear of the machine shop area is the main shop floor where engines and all types of earthmoving equipment are disassembled and rebuilt in accordance with Caterpillar recommendations. One corner of this area is devoted to the shop foreman's office and a tool crib. In the opposite corner, at the rear of the shop, is a tank for cleaning small parts.

Large assemblies and in some cases whole tractors or engines are cleaned before they enter the shop in a smaller building adjacent to the service yard at the rear of the main building. This smaller building also houses the paint shop, and has a third room for storage of engines or engine-generator sets waiting for overhaul. Heavy construction equipment is stored in the service yard while awaiting repair or overhaul. So much for the looking around, now let's ask a few questions.

Q. Otto, how many men do you have in all?

A. Well, first of all, there is quite a little more to our operation here than meets the eye just walking through the shop. There are about 20 men regularly assigned to the shop. However, we have 13 service trucks on the road constantly. Each truck is manned by one mechanic.

Q. Then a good portion of your repair and servicing work is done away from the shop, or in the field.

A. Yes, in fact I would say that we do more work in the field than we do in the shop by a large percentage.

Q. What kind of work do you do in the field?
A. Almost anything. You are probably thinking that its all preventive maintenance, component replacement, and adjustments. This is true to a degree and perhaps accounts for a good part of the field work, but it is not uncommon for a field man to do a complete overhaul in the field.

Q. Do you mean that you do complete rebuilds in the field?
A. Wait a minute. We distinguish between overhaul and rebuilds. Usually we refer to an overhaul as ring, piston and/or liner replacement and in some cases bearing replacement, as opposed to a rebuild, where the engine and assemblies are completely rebuilt in the shop under close control and more ideal conditions.

Q. In such a case does the mechanic do the job alone, or does he work with the help of another man?
A. Where a job is too large for the mechanic to handle alone, we assign a mechanic from the shop to help him.

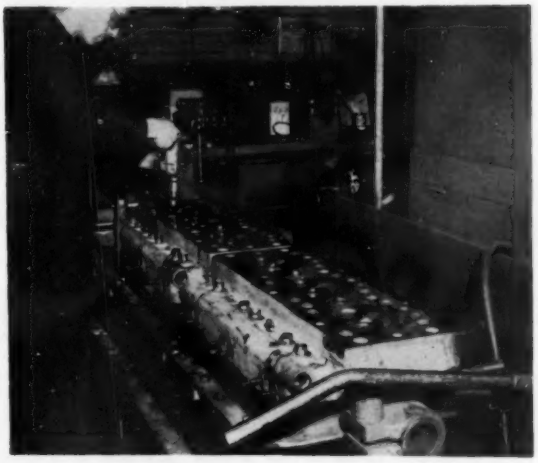
Q. Do you overhaul component assemblies in the field?
A. Not generally. This is usually done in the shop. Where a component assembly fails in the field, we usually install a replacement unit to keep the machine on the line.

Q. How do you handle component assemblies—is it on an exchange basis?
A. Yes. In fact we have a comprehensive exchange plan which covers most component and sub-assemblies for which there is a large demand, and we have found that the program reduces greatly the time required for repairs and permits the rebuilding of these assemblies on our regular schedule, rather than with a rushed deadline usually required when a customer's machine is down. This results in better quality workmanship.

Q. Speaking of replacement, we noticed a number of machines which seem to be partially dismantled, standing in the service yard out back.
A. We do quite a bit of work out there in the yard. In many cases a machine will come in for a repair in which only one or two assemblies require work. When this happens, we leave the machine in the yard and remove only those parts requiring work. When the assembly is repaired the mechanic that removed the unit will take it out to the yard and reinstall it right there. This keeps the main shop clear for the big jobs such as complete engine or machine overhauls and the like.

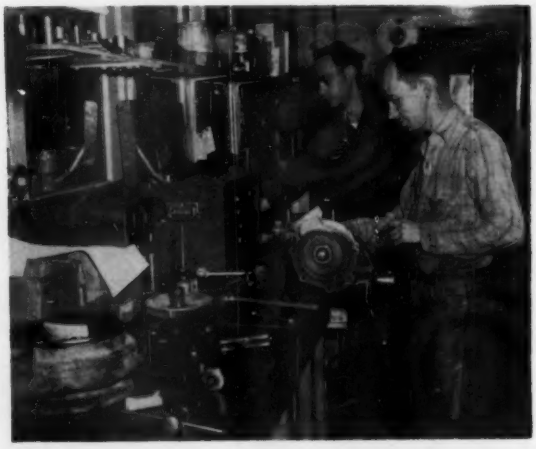
Q. You said the mechanic that removed the assembly or component, would replace it. Is this the practice used on all repair or rebuilding jobs?

Engines entering the shop are dismantled, parts tagged, and routed to various departments for servicing. Rebuilt or replaced parts converge on build-up station in background.

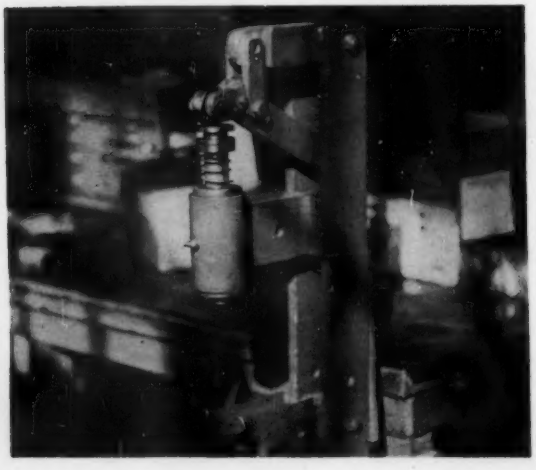


In the machine shop area all unit rebuilding is handled. Above, mechanic cleans up cylinder head with wire brush chucked in electric drill. Below, larger electric drill with hone attachment is hung on springs for reconditioning cylinders.

An enclosure in one corner of the machine shop houses all equipment necessary for the inspection and rebuilding of hydraulic equipment. Included in the equipment for testing hydraulic systems is a hydraulic pump powered by a Ford V-8 engine. Test loads are imposed on hydraulic cylinders by limiting travel.



In another section of the machine shop area is a glassed-in room for the repair of injection equipment, transfer pumps, governors, water pumps, and electrical equipment (above). Below, a closeup of a shop-fabricated riveting machine. This machine takes over where an extra-heavy rivet must be used on the equipment.



A. Yes, we find it better to have one mechanic follow a job through from start to finish and be responsible for operation of the completed unit, whether it be a complete engine or tractor or just one of the assemblies. There seems to be a certain satisfaction to the mechanic too when he completes a job and the unit checks out as it should.

Q. Can you give us a brief description of what happens when an engine or machine is brought in for rebuilding.

A. Well, for the sake of simplicity, lets stick to the engine. When it arrives, it is cleaned externally and brought into the shop for teardown. Parts are cleaned, tagged, and routed to the proper department for inspection and repair if necessary. For example, piston assemblies are sent to the machine shop where pistons, pins and rods are thoroughly checked. These come back to the mechanic as an assembly, with pins fitted according to the manufacturer's recommendations, rods checked for elongation, twist and so forth. Cylinder heads are also sent to the machine shop for a working over. Starting engines too are completely rebuilt in the machine shop.

Q. What happens when you discover a head is cracked?

A. We don't do any cylinder head welding. We feel this is best done by specialists and for this reason send any heads to be welded to "Superweld" in New York City. The time lag is taken up by the use of one of our replacement heads.

Q. How is crankshaft and camshaft grinding handled?

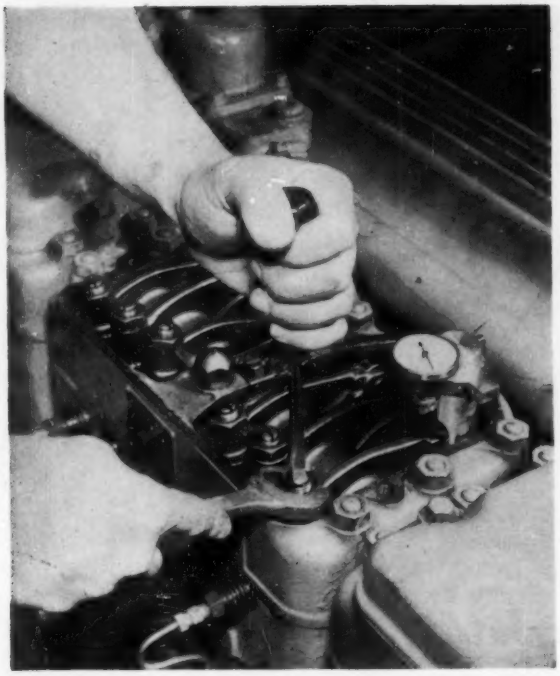
A. Again, we feel that this work can best be done by specialists outside. We have access to several machine shops in Philadelphia which do a fine job of this work. Then there are economic reasons too. We do not feel that we could economically justify a specialist and the equipment he would require, on the basis of the number of shafts we find requiring regrinding.

Q. When an engine is rebuilt and ready to go, what procedure do you follow for "run-in"?

A. We run the engine for two or two and one half hours, during which time, all final adjustments are made and the engine checked for malfunctions, leaks, etc. If a machine is involved, the entire unit is checked both for engine operation and operation of the machine.

Q. Do you advise the customers to "run-in" their newly-rebuilt engines on the job, say at part load and reduced speed for a specified period.

A. During the 2-to 2½-hr run-in period, the machine has imposed a partial load on the engine. We feel that after this, if the engine has been properly rebuilt in accordance with manufacturer's recommendations, it is ready to assume full load operation.



At left is a Model 212 Valve-Gapper on a Cummins Model HB engine. Cummins J Series engines are serviced with this model also. For NT and NH Series engines, the Valve-Gapper Model 213 (shown below) is used.

Valve-Gappers for Cummins Engines

P&G Manufacturing Company has broadened the application of the Valve-Gapper by introducing two models for Cummins diesels.

VALVE-Gapper application has been broadened. Available for GM Series 71 and 110 diesels for some time, now two new Valve-Gapper models have been designed specifically for use on Cummins engines. These are the No. 212 and No. 213. The two new models now make micrometer-accurate valve clearance adjustment possible on Cummins H and J, NT and NH series diesel engines respectively.

Both instruments utilize a patented method of measuring the exact valve clearance with a dial indicator which is graduated in 0.001-in. According to the manufacturer, P&G Manufacturing Co. of Portland, Ore., this method of measuring valve "gap" permits a positive visual reading of the valve clearance before, during, and after adjustment, regardless of the wear on the valve stem or rocker arm.

Photo of the Model 212 on a Cummins HB engine illustrates how the mechanic has both hands free to use adjusting tools and can make micrometer-accurate adjustments on every valve without depending on feel. Engine performance is improved by this uniform and accurate method of adjustment, only the method of measurement is different.

The models available for General Motors 71 and 110 series diesel engines (see Diesel Power, January, 1954, Page 88) are designed for adjusting valves, timing fuel injectors, and balancing fuel racks. Accessories are also available for other GM diesel engine overhaul work (see Diesel Power, February, 1955, Page 50). Included in the latter are adapters for measuring cylinder liner-to-top-of-block distance, cylinder liner and block bores, and depth of the counterbore for the cylinder liner.

In summing up, it might be well to point out that the Valve-Gappers are precision instruments, developed with the idea of speeding tune-up and overhaul work. While they were originally developed as a tool for precision adjustment of valves, they have been made more versatile through the use of various adapters.

By eliminating the need for the feeler gauge, the Valve-Gappers not only free the mechanic's hands, but also compensate for slight concave wear between valve stem and rocker, not measurable with feeler gauge.

OIL FILTRATION AND PURIFICATION
Lubricating Large Engines
Modern Diesel Oil Mainte
On-the-Spot Lube Oil Evaluation
Lube Oil Difficulties with Bunker C Fuel
By Robert Dodd

Following up on last month's survey of lube oil and filter change practices among some small trucking outfits, the apparent confusion concerning these subjects prompts the question . . . .

What IS the Lube Oil and Filter Change Problem?

By B. P. Emerson, Editor

"GREATER service life for lube oil and filter elements." A desire for this objective is the single point of agreement in the survey of lube oil and filter changeout practices presented last month. Individual practices and viewpoints ranged all over the lot. One thing was very apparent: there was no agreement, in fact there was not even recognition of the factors influencing lube oil and filter service life.

Answers to some survey question implied, if not actually stated, that someone, probably the engine builder or the oil supplier, should be able to tell the operator when the oil and filters should be changed. There was no mention of oil sampling, engine condition, operational details, or even the type of filter system used. In short, they expected an answer to be pulled out of a hat.

This apparent unawareness of the very nature of the overall lube oil problem is a major part of the problem itself.

Now why does this informational vacuum exist? This is challenging to us because we have devoted a great deal of effort to supplying information on these subjects. And we're not alone. There are books, technical society papers, booklets, and brochures from both engine and oil companies, all devoted to this subject. Firsthand advice and service can be obtained form service engineers representing the engine builder or the oil supplier.

No, there is no lack of information, but apparently some operators are on a different wave length and the message isn't coming through. Let's look for clues.

Early in the survey the contention is made that the diesel operator is subjected to "claims and counter-claims, misinformation, prejudice, buck-passing, incomprehensible data, lack of specific data, and more particularly some of the recent 'miracle' filtering advertising claims." Boiled down, two points come through: our operator isn't getting what he wants; and he has trouble evaluating what he gets.

On the evidence at hand we are not sure that the operator knows exactly what he does want, or at least is asking for something that it is impossible to give him. That "incomprehensible data" bit brings up a point. A good deal of the data available to the man in the field is so technical that even the best engineers have to digest it slowly. The "long-haired" approach is silly; we need a real down-to-earth approach to the solution of field problems.

This need for a simplified approach is another part of the overall lube oil and filter change problem. It can be done and to a great extent is being done.

Some of the available analysis services, blotter tests, and the more elaborate used-oil evaluation kits are pointing the way. They'll give you a practical evaluation on the basis of up to five items: (1) Viscosity—as a measure of

fuel dilution; (2) Insolubles—indicating the abrasive particles found; (3) Solubles—showing the deposit-forming tendencies; (4) Water—causing sludge; (5) Neutralization Number—expressing acidity.

Some or all of these indicators are used to get an idea of whether the oil is fit to be continued in service. When such tests are made regularly, they will also monitor filter effectiveness. Simple instrumentation to measure the pressure drop build-up across the filter element will also help determine when a change is needed.

These are some of the things that we plan to cover in detail in future issues. Right now, all we want to point out is that even the most simple approach, perhaps because of its simplicity, requires a double helping of judgment.

No matter how simple you make things, you keep coming back to the fact that the operator has to know something about the problem; he can't avoid accepting some responsibility. It is up to all interested parties, including ourselves, to make available pertinent, comprehensive, and down-to-earth information; it is up to the operators to latch on to and use this data for their benefit.

But operators say that they don't know what to believe; that they get "claims and counter-claims, misinformation, etc." It seems to us that this phase of the "evaluation" angle is more a matter of gullibility than anything else. If you are the sort of person that Barnum had in mind when he made his famous remark, there's nothing to be done. Otherwise, it seems to us that common sense and a reasonable amount of background knowledge would enable you to see through some of the weird claims being made today.

If we were asked to set up a guide for evaluating some of these much-touted products, we might start with a formula something like: The value of the product varies inversely as the wildness of the claims. Next, we would recommend careful analysis of what is said (and note what is carefully skirted or weasel-worded) about the product.

One thing that slays us is this "fully guaranteed" statement. Guaranteed to be what? or to do what? It's never made quite clear. Then there are the performance characteristics that you can't quite tie up. For instance, long filter life or high gpm throughput might be claimed, but with no data on the fineness or efficiency of filtration. It's no trick to get high life or throughput if the filter doesn't catch anything!

We recently saw results of tests wherein two of the recent crop of "sensational" lube oil filters were compared with a well-known and reputable brand. These were independent and objective tests conducted in accordance with the best accepted testing procedures. We'll not go into all the figures but will cite a conclusion. The laboratory commented that the two "sensational" filters were *little if any better than no filter at all.*

Now for the commercial. You won't find this sort of thing taking place with reputable firms who value their brand names. Take a look through the advertising in DIESEL POWER. These fellows are competitors in a competitive business and naturally they are proud of their products and put their best foot forward. They give you some understandable facts and data that they are ready to prove.

We'll bet that you didn't see one outfit that had "discovered" something "revolutionary" that was going to make all similar products "obsolete". Not one promised to "slash costs in half." You're probably disappointed too that not one firm is "fearlessly" introducing a "sensational development" that is going to "crack wide-open" the long-term "plot" to "bilk" the diesel user by keeping the "superior" design off the market.

You are probably familiar with the words and music. Why anyone falls for this stuff beats us. If we were looking for sound products and sound information, we'd play the percentages. We'd look for a good reliable firm with a well-known brand name. End of commercial.

So still another facet of the whole lube oil and filter change problem is the recognition and avoidance of, shall we say, non-objective claims.

Understand, we make no statement that all new things are bad. Quite the contrary. With all the good minds working on development, it would really be strange if we had no product improvement. But progress is gradual; you do not "double" or "triple" efficiencies over night.

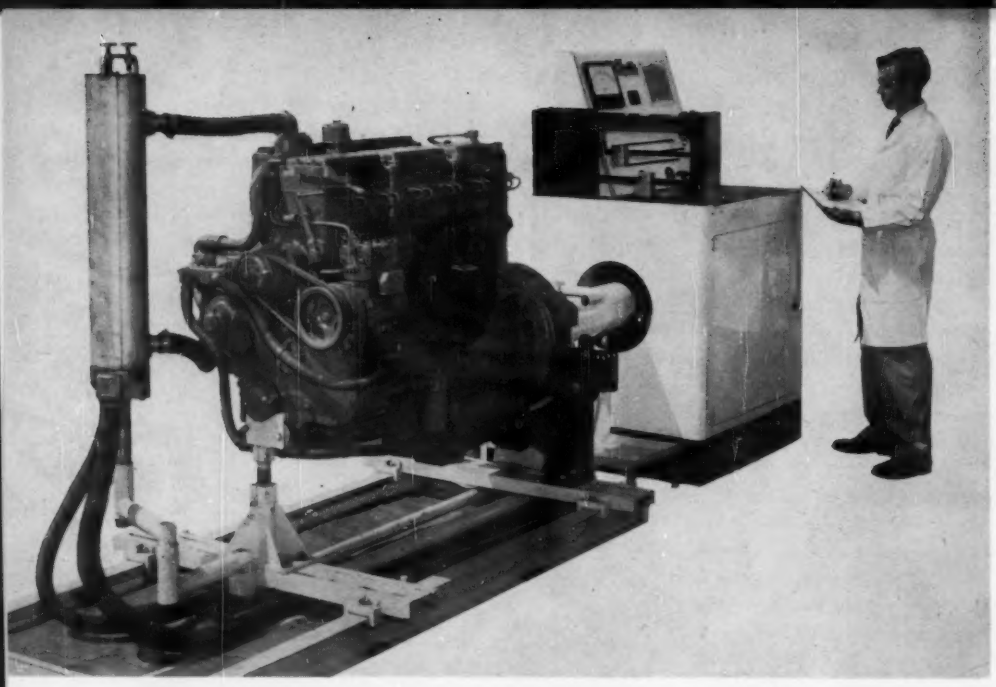
You'll find that when such startling claims are made, they are generally in areas where testing is difficult. As the survey states, it is tough to test filters in the field. So you can make just about any claim and/or substantial price concessions for a filter element and get away with it—at least for a while.

This subject could be pursued indefinitely, so let's ask just one question. Why do reputable filter manufacturers penalize themselves in the face of high-pressure competition by sticking to relatively conservative performance claims and higher element costs? If it's so easy to make a good cheap filter element, why do they spin their wheels? You know the answer and it is another reason for sticking to reputable brands.

All right now, what *is* the lube oil and filter change problem? We've developed what we think are some important facets of the whole picture. The first indicates a lack of knowledge on the part of the diesel operator; the second, the need for a simple field approach to the problem; and finally, the need for background information by the diesel operator as a basis for decision.

Fundamentally, all of these involve information. Areas of responsibility are implied. Those with the data have the job of supplying it in a form that can be used; from then on it is up to the diesel operator. We think to date, "suppliers" have done a better job than the "absorbers."

It's not enough to "want" to increase lube oil and filter life, you have to work at it. Unless an operator is prepared to do a little digging and learn something about the whole subject, he would be well advised to stick to the engine builder's recommendations. Engine lubrication is too important to be taken lightly; a wrong move can be very costly.



A Cummins automotive-type diesel mounted on the Clayton Universal Engine Stand and connected to a Clayton Model 17-500 CM engine dynamometer. Clayton Universal Cooling Column is at left.

Run-In and Testing by Dynamometer

by George R. Mackey, *Manager*
Industrial Dynamometer Division
Clayton Manufacturing Company

Run-in on a dynamometer at controlled speeds and loads is the best and safest way to prepare an engine for full power application. Opportunity for inspection and adjustment insures a power-proven engine with long life expectancy, eliminating comebacks or expensive warranty claims.

"TO say that 'the first few hours of operation are the most critical for a new or rebuilt engine' sounds superfluous because every mechanic already knows it to be true. If an engine actually fails during this period, the failure is generally the result of poor assembly procedures which can be detected easily; or it is due to an attempt to 'break-in' the engine too rapidly.

"The break-in period offers the only opportunity to seat piston rings properly, but this fact is not always recognized. If a new or rebuilt engine is run without load for any considerable period, the rings may not seat and there may be excessive oil consumption and excessive blow-by. It is extremely important that the proper break-in procedure be followed to avoid this condition. Certainly the operator is responsible for the way the engine worked after he gets it on the job, provided he has been properly instructed. Although chrome-plated rings last longer, they require a careful break-in period.

"The break-in procedure described in our instructions has proved most effective and we sincerely believe that you will realize important benefits from its use."

Value of run-in and dynamometer testing for rebuilt engines is adequately summarized in this letter sent to the distributors of one major engine manufacturer.

Proper seating of piston rings and run-in of engine parts under controlled loads has proved one of the most important factors in building the life expectancy of a new engine into a reconditioned unit. By contrast, experience has proved that running-in diesel engines at idle speed or under free-load conditions for extended periods actually does more harm than good. Engines that are subjected to these operating conditions are often found to perform unsatisfactorily in the field because cylinder walls have "glazed" before ring seating occurs.

This glazing is due to low combustion temperatures and the incomplete combustion that occurs during a no-load run-in. Resulting short engine life, costly warranty work, high lube oil consumption, loss of power, and dissatisfied customers are commonplace in service operations practicing this old-fashioned, impractical method.

Initial under-load run-in permits newly machined piston ring surfaces to seat against newly honed cylinder liner surfaces under controlled temperatures and pressures. Thus, as the parts take their final finish, they have formed the actual "lapped" seats that exist during the

ENGINE DYNAMOMETER TEST REPORT

Date _____ Engine Make _____

Repair Order _____ Engine Model _____

Engine Serial Number _____

PRE-STARTING

1. Prime Lube Oil System		3. Adjust Valves (Cold)		5. Adjust Fuel Inj. Pump	
2. Prime Fuel Oil System		4. Adjust Injectors (Cold)		6. Adjust Governor	

BASIC ENGINE RUN-IN

Time at Speed	Time Start	Time Stop	RPM	BHP or Scale Reading	Water Temp.	Lube Oil Press.	Lube Oil Temp.	Blow-by or Crankcase Press.	Air Intake Depress.	Exh. Back Depress.	Blower or Super Charger Press.

BASIC RUN-IN INSPECTION

1. Check and Tighten all Bolts		4. Inspect for Water Leaks	
2. Inspect for Lube Oil Leaks		5. Check Valve Mech. Lube	
3. Inspect for Fuel Oil Leaks		6.	

BASIC INSPECTION

1. Tighten Cyl. Head (Hot)		3. Adjust Injectors (Hot)		5. Adj. Governor	
2. Adjust Valves (Hot)		4. Adjust Injection Pump		6. Adj. Fuel Control Racks	

FINAL RUN-IN and TEST

Time Start	Time Stop	Governed RPM No Load	Governed RPM Full Load	BHP or Scale Reading	Water Temp. Full Load	Lube Oil Temp. Full Load	Lube Oil Press Full Load	Lube Oil Press Idle

Fuel Oil Press. Full Load	Blow-by or C C Press. Full Load	Air Intake Depress. Full Load	Exh. Back Press. Full Load	Blower or S. Charger Press. Full Load	Idle Speed	Overspeed Trip

Fuel Consumption Test _____ gallons _____ pounds During _____ Minutes Full Load Operation

TEST CONDITIONS ALTITUDE _____ FT. BAROMETRIC PRESSURE _____ IN. HG. TEMP. _____ °F.

Engine Manufacturer's Standard Test Conditions: Altitude Not Over _____ Ft.; Barometric Pressure Not Below _____ IN. HG.; Temperature Not Over _____ °F.

Derate Horsepower and Decrease Fuel Injection Rate: 3% for EACH 1000 FT. ALTITUDE RISE ABOVE STANDARD CONDITION; 1% for EACH 10°F. TEMPERATURE RISE ABOVE STANDARD CONDITION

INSPECTION AFTER FINAL TEST

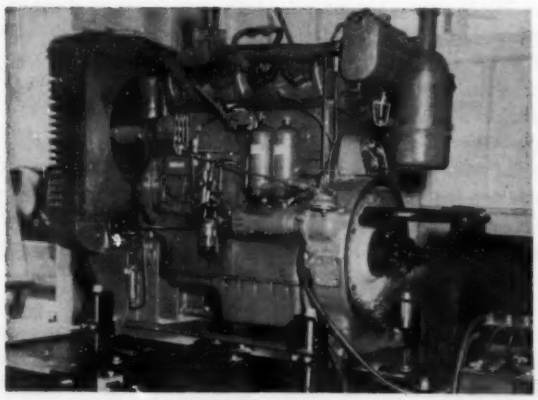
1. Check Generator Charging Rate		2. Check Air Compressor		3. Check Power Take-off	
4. Check Emergency Shutdown System		5. Check and Clean Lube Oil Filters			

Remarks:

Signed _____ Date _____

Dynamometer Operator

Note: Dynamometer Operator must initial each check and sign this report.



Universal engine stand arranged with power unit pedestals for the mounting of this International Harvester industrial power unit. Here, power unit radiator is used in place of cooling column.

life of the engine. Friction normally found after overhaul is gradually overcome by progressively increasing run-in loads, with a resulting increase in both temperatures and pressures, until it is safe to place the engine under actual full-load operating conditions.

A typical example of the advantages of running-in engines can be visualized when we consider the surface contact of new piston rings to a new cylinder liner. Many production rings will show an incomplete contacting surface when viewed under a light test. With this condition existing, pressure leakage past the rings, and the resulting buildup of fuel residue can easily be visualized.

Before a full load is placed on the engine, a perfect seal by the piston rings can only be obtained by a pro-

gressive run-in. Engine power output and speed are controlled so that normal operating temperatures will gradually cause the rings to contact the liner and effect a total sealing contact.

Whereas no-load run-in may never accomplish the desired conditions between moving parts in an engine, immediate full-load operation can also be harmful. It will often cause ring or piston seizure and liner scuffing by too rapid acceleration of the lapping or running-in process.

Engines released to customers for immediate service and not having had sufficient run-in, may be deficient in many other respects. There is no possible way to ascertain power output or performance characteristics of an engine unless it has been subjected to a complete run-in and dynamometer test.

Also, when an engine is being run-in, opportunity is afforded to locate "bugs" or malajustments before the engine is delivered to the customer. During the final portion of the dynamometer test, final, tune-up and adjustments can be made to assure that the engine is developing its rated power and that the engine will meet the manufacturer's specifications.

Histories of rebuilt engines show that many failures such as fuel, oil, and water leaks, etc., occur during the first few hours of under-load operation. If failures are going to occur, it is best and far less expensive if malfunctions are found before the engine leaves the service shop. By following a recommended dynamometer run-in and test procedure, most of them can be caught in time and the necessary repairs made, thus eliminating profit-eating "after service warranty" field trips and "do-over" jobs.

Preparing for Run-In and Test

As much information as possible should be on hand concerning the engine to be run-in and tested. This should include specifications, performance data, adjustments and clearances, injection equipment and governor settings, details of standard equipment, etc. Also, "Engine Dynamometer Test Report" forms of the type shown should be used for recording each step of the run-in and final dynamometer test precedure. Additional tests or deviations from the normal test procedure and the resulting engine performance should also be noted.

Only a basic engine should be subjected to a normal service dynamometer run-in and test. This should include complete basic engine equipment. Where accessories or additional equipment which do not affect the engine's power output are to be installed and inspected, this should be done after the basic test is completed.

Many published power curves show the performance of the basic engine only and do not include normal losses encountered in transmitting power through transmissions, torque converters, or reduction gears. Furthermore, installation of these assemblies may affect the end-result of a complete inspection. For example, a leaking rear crankshaft seal may be missed if the flywheel and open flywheel housing are covered with a clutch housing or gear box. This would defeat the purpose of the inspection—elimination of do-over work and service during the overhaul warranty period.

In some cases it is necessary to test through certain drive-line components, but this is the exception rather than the rule. The general construction of certain torque converters and marine gears in which the drive mechanism provides the necessary flywheel effect is a case in point. When omitting these assemblies, it may be necessay to mount a test flywheel on the engine.

Testing through torque multipliers may involve many additional difficulties. Take the case of a reduction gear. First—installation requirements for an engine equipped with reduction gears may be costly in both time and material. Second—reduction in output shaft speed and the resulting increase in torque may be beyond the operating characteristics of the dynamometer.

The unique design characteristics of Clayton's "Turbo-Closed System" engine dynamometers permit a maximum power absorption rate at a minimum rpm that matches the performance characteristics of most medium and high-speed diesels. Yet when we compute horsepower and torque, we can readily understand the results of testing an engine through a reduction gear.

The horsepower formula is:

$$\frac{\text{Torque x rpm}}{5250} = \text{HP}$$

or to determine torque

$$\frac{rpm}{\text{HP x } 5250} = \text{Torque}$$

Then if an engine develops 783 ft. lb. torque at 2000 rpm, horsepower output will be 300. But if we transmit this horsepower through a 4:1 reduction gear, we will then be developing 300 hp at 500 rpm (output shaft speed). Computation shows the torque now to be 3150 ft. lb. To absorb such loads would require a dynamometer with both a size and price that might make it beyond the reach of general service operations.

Now let's comment briefly on each engine system.

Air System—All engines should be dynamometer tested with the standard air cleaner or silencer approved for the engine model. These should be mounted in a conventional manner that will assure operation within the engine manufacturer's air intake restriction or inlet depression specifications. It has been found very beneficial to test the engine with its original air cleaner or the one with which it will be delivered. This has helped many service organizations to eliminate engine performance complaints after overhaul, due to faulty or plugged air cleaners.

Exhaust System—The standard engine exhaust manifold should be connected to the test room exhaust system. This system should consist of suitable exhaust pipe and silencer to handle the exhaust gases and while silencing the exhaust noise, still show a back pressure within the specification of the engines to be tested.

Exhaust connections should be flexible enough to prevent undue expansion and vibration stresses at the manifold flange, and connected in a manner to prevent leakage of exhaust gases into the test room.

Cooling System—Engines equipped with water pumps and oil coolers must have these assemblies installed for test. Engine cooling fans should not be driven during the engine test except when testing complete power units. When driven, refer to or determine the power specifications for engines operated with fans.

Fuel System—Engine-mounted fuel transfer pumps, water traps, primary and secondary fuel filters, manifolds or lines, are part of a basic engine and should be used during the dynamometer run-in and test. Fuel tanks for the types of engines to be tested, set at a suitable location, should be included as part of the test room equipment. Also, it may prove advantageous to install an auxiliary fuel tank (approximately 5-gal capacity) so that a short dynamometer test can be made on the customer's fuel for comparison to the engine's performance on a known fuel.

Lubrication System—Engines equipped with oil pump, relief or regulating valves, filters and strainers, as standard equipment, should have these items installed for the dynamometer test. New lube oil filter elements should be installed prior to the run-in and test. All engines must be tested with the filter or strainer system normally used by the manufacturer.

Note: Refer to the engine manufacturer's specifications for both fuels and lubricants. Fuels and lubricants not having the same specifications as those recommended may not give the desired results.

Mounting the Engine

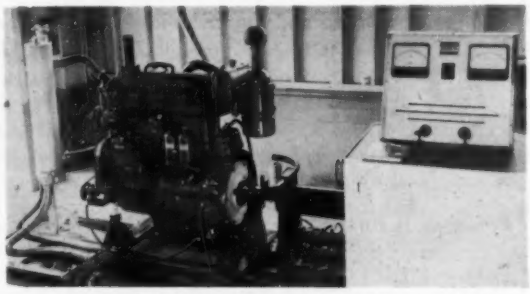
For maximum utility of the time-saving and universal features designed into Clayton's "Universal Engine Test Mounting Adapters", those required for mounting the engine on the test stand and connecting into the dynamometer drive shaft should be installed on the engine at the end of the overhaul area. Where the work load is very high, a special preparation area can be used. Adapters for rear flywheel housing mounts, flywheel drive, cooling system, and other necessary connections, should be installed prior to mounting the engine on the test stand.

Remember that during the test the engine and mounting adapters will be subjected to all the stresses and strains normally encountered in the actual engine application. Therefore, all mounting equipment used should be installed properly. Makeshift or temporary mounts or connections can be both dangerous and costly and should not be used.

Before installing the engine, the mounting stand is adjusted. Cross-rails should be set to their proper position with rear and front supports properly positioned to receive the engine in proper alignment with the dynamometer.

The engine can then be set in position and all securing bolts tightened. Two typical engine dynamometer test installations are shown.

All fuel, supply lines, water connections, etc., can now be connected, as well as the electrical system. Where the engine is not equipped with a starter switch, the remote control switch and solenoid supplied by Clayton should be installed. Be sure all drive-coupling bolts; hold-down bolts; mounting bolts; air, fuel, lube, water, and exhaust connections are tightened before starting the engine.



An International Harvester diesel mounted on the Universal Engine Stand. Again, cooling column is used. Engine is connected to a Clayton Model 17-500 CE engine dynamometer.

Preparation for Starting

Filling Lubrication System—Many diesel engine manufacturers recommend that the lube oil system be primed before engine starting. A practical method for priming is to attach a line from a suitable primer to one of the main oil galleries and to admit oil under pressure until lube oil has reached all bearings and other surfaces dependent upon lubrication for safe operation. After priming, the crankcase must be filled with the proper amount of recommended lube oil.

Priming the Fuel System—Most diesel engine manufacturers recommend that all fuel passages and lines in the entire fuel system be full of fuel before the engine is started. This can be accomplished by attaching a suitable primer to the fuel inlet connection and continuing to admit fuel until the system is properly filled. It may be necessary to bleed air at various points. Priming is required when the engine is started the first time and on some engines is necessary after an engine runs out of fuel and air enters the fuel system. Priming also assures initial lubrication to all moving parts of the fuel pump and fuel injection system.

Preliminary Valve Clearance and Fuel Injection System Check—A preliminary valve clearance and fuel injection system check should be performed and necessary adjustments made before the engine is started. This will assure the proper operation of these parts during the initial engine run-in.

Engine Cooling System—Fill the engine cooling system until the water reaches the proper level. The water level is visible in the sight-glass mounted on the side of Clayton's "Universal Cooling Column". Be sure that all engine water drain cocks and plugs are tight and that there are no water leaks. With proper adjustment of "Cooling Column" temperature controls, the desired water temperatures will be automatically maintained under all normal run-in and dynamometer test conditions.

Test Instrumentation

Test instrumentation required will depend upon the type of engines tested and the under-load checks to be made and recorded as the test procedure is followed. A readily accessible and convenient grouping of instruments to be used should be attached to or mounted near the engine. It should include connections for easy and quick attachment of other instruments and gauges that may be required for certain checks on engine operation.

Following is a breakdown of the more common checks and the general method of instrumentation:

For checking engine oil pressures—a pressure gauge should be installed in one of the engine oil galleries.

For checking engine oil temperatures—an oil temperature gauge of adequate temperature range should be installed in place of the dip stick, or in the dip stick hole in the cylinder block.

For checking engine water temperatures—the gauge mounted on the "Cooling Column" is both accurate and easily read. No other temperature gauge will be required.

For checking air intake depression—a water manometer or vacuum gauge of adequate range should be connected to the air inlet housing in a manner that will give an accurate measurement of the air inlet restriction to the engine.

For checking exhaust back pressure—a suitable manometer or pressure gauge should be installed at the exhaust manifold outlet so as to assure an accurate measurement.

For checking crankcase pressure—a water manometer or suitable pressure gauge should be connected to the engine crankcase, either at plug openings in the cylinder block (if the engine is so equipped) or from the top of the dip stick holder. Operators often have prepared plates equipped with connector fittings, or oil filler caps equipped with connector fittings, which are installed on the engine prior to starting the dynamometer run-in and test.

For checking blower pressure or supercharger pressure—a manometer should be connected to the air inlet manifold for blown or supercharged engines, and to the air box for 2-cycle engines. A suitable pressure gauge may also be used.

For checking exhaust temperature—an exhaust temperature gauge or pyrometer should be connected to the exhaust manifold. Insofar as the accumulated exhaust gas temperatures are generally considered sufficient for service testing, the instrument should be connected close to the outlet of the manifold.

For checking fuel consumption—one of two methods may be used. A fuel rate flow meter can be installed ahead of the fuel injection pump (not suitable on circulating systems); or, fuel used during a predetermined period of time can be accurately measured by weighing a quantity of fuel and after running the engine, the remaining fuel weighed and subtracted from the original supply.

Making a Dynamometer Run-In and Test

While desirability of dynamometer run-in and test is mutually endorsed by major manufacturers of diesel engines, they differ in their opinion as to specific run-in and test procedures to be followed. Also, they do not agree as to the amount of time that should be devoted to the various steps of the test procedure. These varying opinions may be due to the difference in engine sizes, design; and operating characteristics, or possibly the engineering departments' opinions on the matter.

Nevertheless, as long as there are differences of opinion by engine manufacturers, material covered in this article is not intended to replace recommendations published by many engine manufacturers. This material is intended to aid those interested in developing a test procedure and should be taken as suggestions rather than recommendations.

We suggest that upon the installation of a Clayton engine dynamometer, the customer should communicate with the supplier of his various makes of engines, requesting a recommended run-in and test procedure as well as other pertinent information he will require.

Determining factors influencing the length of time necessary for complete run-in and test are: amount of run-in time necessary for piston rings and other engine parts to seat sufficiently to allow full-load operation; dynamometer charges that can be passed on to the customer; and the work load of the service shop. Analysis of these three points will enable an experienced service operator to determine the length of time for a dynamometer test and permit scheduling of the work through the shop.

Manufacturers recommending a 2-, 3-, or 4-hr run-in and test period say that many additional hours of underload operation may be required before any decided change in engine performance would be noticed. For example, if piston ring seating will allow at least 95% load to be placed on an engine after a 2- or 3-hr underload run-in, this is sufficient to allow a complete dynamometer test to be made. The time that may be required to run-in an engine to where 100% power can be developed may involve 25, 50, or possibly 100 hours of underload operation. So, the run-in and test procedure may

cover a 2- or 3-hr period, with definite standards being specified for that engine make.

Dynamometer charges made to the customer are another determining factor. Oftentimes a customer will be enthusiastic in spending $30 or $40 for a dynamometer test of an overhauled engine, but this same customer may lose his enthusiasm or even reject a charge of $65 or $75 for a test of longer duration. Also, a shop having a heavy work load cannot afford to run-in an engine for 8 or 10 hours if the desired results can be obtained in a 3- or 4-hr run-in period.

With these facts in mind, and following a similar pattern to that established by many leading manufacturers, the following information can be used as a guide to determine a satisfactory run-in for an engine after overhaul.

Suggested Run-In

For Diesel Engines Having a Rated Speed of 1500 *RPM*

Run-In Period	*Dynamometer Load % Maximum Power*	*RPM*	*Time In Minutes*
1	0	1000	10
2	25	1000	30
3	40	1100	30
4	50	1200	30
5	75	1400	30
6	90	1500	30
7	95 to 100	1500	60

A run-in schedule patterned after this chart, plus the necessary time to mount an engine, make a complete inspection and tune-up, and remove the engine from the test stand, may involve approximately 5 hours. This falls within a desirable time limit for most service operations and enables them to pass on to the customer charges that are within reason. Different time intervals may be substituted, depending on the personal opinion of the person scheduling the work.

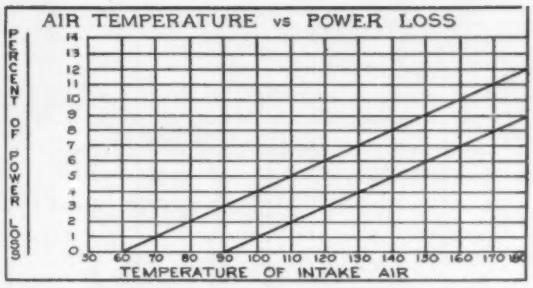
Suggested Run-In

For Diesel Engines Having a Rated Speed of 2000 *RPM*

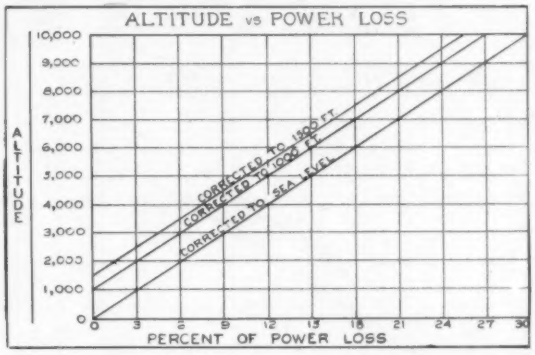
Run-In Period	*Dynamometer Load % Maximum Power*	*RPM*	*Time In Minutes*
1	0	1000	10
2	25	1200	30
3	40	1400	30
4	50	1600	30
5	75	1800	30
6	90	2000	30
7	95 to 100	2000	60

These two charts are self-explanatory with the exception of the second column. These figures are the percentage of maximum horsepower which results at the speed indicated. If an engine is rated 200 hp at 2000 rpm, it does not mean that the second period should be run at 25% of 200 hp, but rather 25% of the rated hp developed at the specified speed in the second run-in period. This is true for each run-in period. Horsepower values at different speeds can be obtained by referring to the engine manufacturer's published performance curves.

If engine oil and water temperatures increase rapidly when moving up to the next run-in cycle, the engine is too tight for safe operation at the increased values. If this condition is observed, revert to the preceding cycle for an additional period and then try the higher values again. This can be repeated until normal temperatures are maintained with each succeeding period of run-in.


AIR TEMPERATURE vs POWER LOSS
PERCENT OF POWER LOSS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
50 60 70 80 90 100 110 120 130 140 150 160 170 180
TEMPERATURE OF INTAKE AIR

A relatively cool volume of air is heavier than a like volume of warm air and therefore contains more available oxygen to burn with the fuel.


ALTITUDE vs POWER LOSS
ALTITUDE
0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000
CORRECTED TO 1500 FT.
CORRECTED TO 1000 FT.
CORRECTED TO SEA LEVEL
0 3 6 9 12 15 18 21 24 27 30
PERCENT OF POWER LOSS

An engine will get denser air at sea level. At higher altitudes, the air is thinner and there is less oxygen to burn with the fuel.

Once again, these run-in schedules are *not* recommendations and are *not* to be followed to the exclusion of those procedures recommended by an engine manufacturer.

Correction Factors

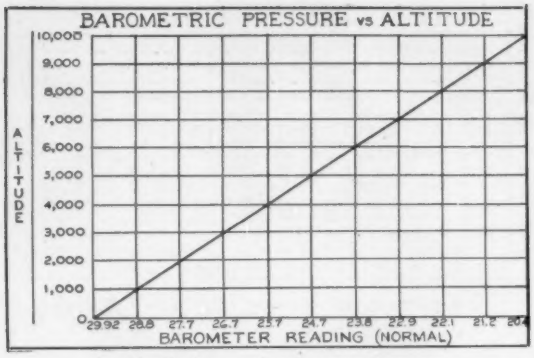
Air temperature, altitude, and barometric pressure have a decided influence on engine performance and must be considered when comparing actual engine power developed to the manufacturer's power curve. These effects are quite commonly overlooked both in the field and in the service test shop.

Three rules cover the effects of temperature, altitude, and barometric pressure respectively:

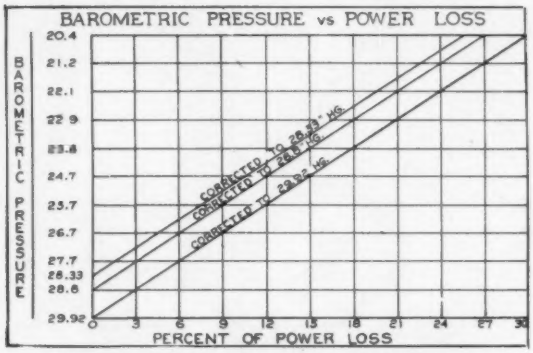
Rule 1—There is a 1% power loss for every 10°F increase above the air temperature specified as standard by the manufacturer.

Rule 2—Power loss (for a 4-cycle engine) is calculated at 3% per 1000-ft rise in altitude above that specified by the manufacturer as standard.

Rule 3—Power loss is calculated at approximately 3% per 1-in Hg barometric pressure under the standard shown on the manufacturer's power curve.



In this chart, normal or average barometer readings are given for the altitude shown, BUT—barometric pressures have been known to change as much as 1-in of mercury, which is the equivalent of 1000 ft in altitude.



Where accuracy of engine power measurement is important, you may want to consult a Barometer and compute the power loss from the manufacturer's curves, and the Barometric Pressure vs Power Loss Chart.

The accompanying charts show this data graphically. Some manufacturers base their power curves on 60°F and some on 90°F. This explains the two lines on the "Air Temperature vs Power Loss" chart. Similarly, some use sea level, while others use 1000-ft or 1500-ft altitude as shown on the "Altitude vs Power Loss" curve. Or the equivalent barometric reading may be used.

In the chart showing "Barometric Pressure vs Altitude", normal or average barometric readings are given for the altitudes shown. But barometric pressures have been known to change as much as one inch of mercury, the equivalent of 1000-ft altitude. When using altitude as a basis for computing power loss, the calculation with such a low pressure could be off the equivalent of 1000-ft or 15 hp in a 500-hp engine. Where accuracy is important, use the barometric method to compute power loss.

In every case, correction must be applied because variation from the standard conditions shown on the manufacturer's power curve will affect the *weight* of air in the cylinders. This is reflected in the engine's power output.

Published horsepower curves may not necessarily indicate the power readings for service dynamometer test purposes. Whereas one industrial engine manufacturer may specify 100% of the rated curve after correction, another may specify 96% or 95% of the rated power curve with correction factors applied.

Now let's take an example. We have for test a rebuilt diesel rated 250 hp. Air temperature in the test cell is 120°F. Test altitude is 5000 ft. Calculating the expected power readings would include:

Step 1—Manufacturer allows 96% of advertised rated power as passable for a rebuilt engine.

250 *hp* ..... *shown on curve*
-10 *hp* ..... *curve reading less* 96%

240 *hp* ..... *passable power output*

Step 2—Manufacturer's curve is corrected to 90°F. Engine air temperature is 30°F over specified correction. By taking 1% for each 10°F above the 90°F specified, we get 3%.

240 hp less 3% equals—

240 *hp* .... *passable power output*
- 7 *hp* ..... *temperature correction deduction*

233 *hp* ..... *corrected passable power*

Step 3—Test elevation is 5000 ft. Manufacturer's power curve is corrected to 1000-ft altitude. Extra altitude for correction is 4000 ft. By deducting 3% per 1000 ft above that specified on the curve:

3% x 4=12% reduction in power output

233 *hp* ..... *passable power output corrected for temp.*
-28 *hp* ..... *correction for altitude difference*

205 *hp* ..... *passable under existing test conditions*

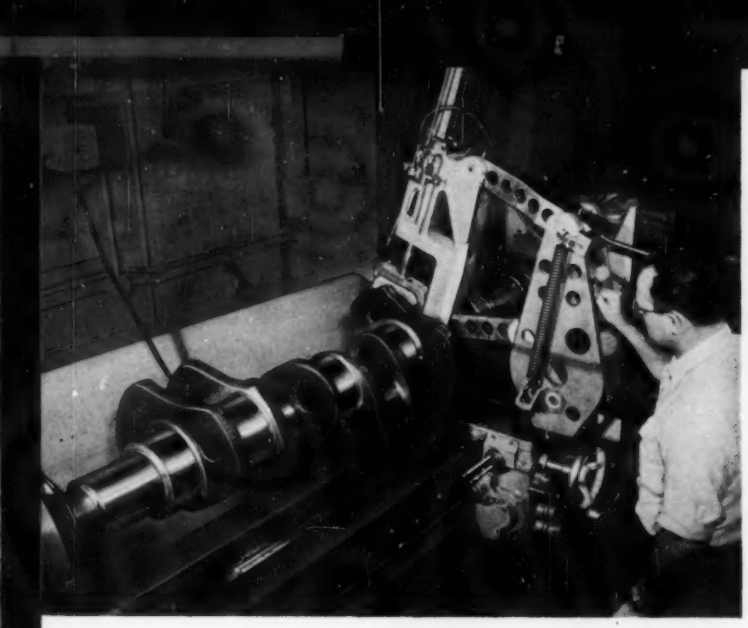
As mentioned earlier, applied barometric reading will give a greater degree of accuracy. Suppose that a low pressure area existed around the test site with the barometric pressure at 23.9-in Hg instead of the normal 5000-ft pressure reading of 24.8-in Hg. This would be the equivalent to another 1000 ft in altitude and require an additional correction of 3%. This would reduce the expected power to 199 hp.

These problems are being encountered in the field every day. If an accurate power check is to be made on engines, correction factors *must* be applied.

Conclusion

Today, leading engine and equipment manufacturers are encouraging the use of dynamometers as a regular feature in a distributor-dealer service operation. All realize the benefits of under-load run-in and test of engines before delivery to the customer.

This practice benefits the customer by assuring that a life expectancy of or approaching that of a new engine has been built into the reconditioned unit and that its power is restored. It benefits the service shop by permitting irregularities to be caught in time and repaired. This eliminates expensive warranty claims and "do-over" jobs. Everyone benefits.



Superfinishing lathe attachment is mounted on tool post cross slide of lathe. Oscillation is built in and has variable speed. The stoneholder arm is lever operated and stone is held to work by adjustable spring.

Superfinishing Crankshafts with Lathe Attachment

"Mirror-like" surface improves dimensional accuracy and increases crankshaft life.

CRANKSHAFT journals must have highly polished surfaces but this is not just for "eye appeal." Sound engineering reasons demand such bearing surfaces be finished in the 3 to 5 micro-inch RMS range. Naturally if these "mirror-like" finishes are beneficial for new shafts, they're certainly just as important in reconditioning work.

Those shops who have been lapping and polishing journals after grinding can now produce these fine finishes on any bearing surface in a single operation. This is done by an attachment mounted right on your own lathe. This superfinisher is made by the Gisholt Machine Co., as part of their line of special surface-finishing machines.

Being adaptable to a lathe, no special machinery is needed. Shafts, etc., can be moved from the grinder directly to the lathe for superfinishing. As a matter of fact, journals can be superfinished without grinding where dimensional conditions permit. However, saving of time and labor is far from being the whole story.

Frequently, the useful life of a component is limited by surface wear rather than by breakage. Superfinishing, reduces this surface wear. How this is accomplished will now be discussed.

First, the surface geometry of the work is improved by removal of grinding ridges, chatter marks, feed spirals and grinder flats. This is done by using a stone curved to conform to the work surface. Since this stone is inflexible and has area contact with more than one pattern of any ridges, waviness, or chatter marks, it leaves a surface which conforms with the correct average diameter. The stone is self-shaping to this correct average diameter. Although taper and out-of-roundness involving the entire diameter is not eliminated, a perfect curvature is produced. Also all defects smaller than the face of the stone are eliminated.

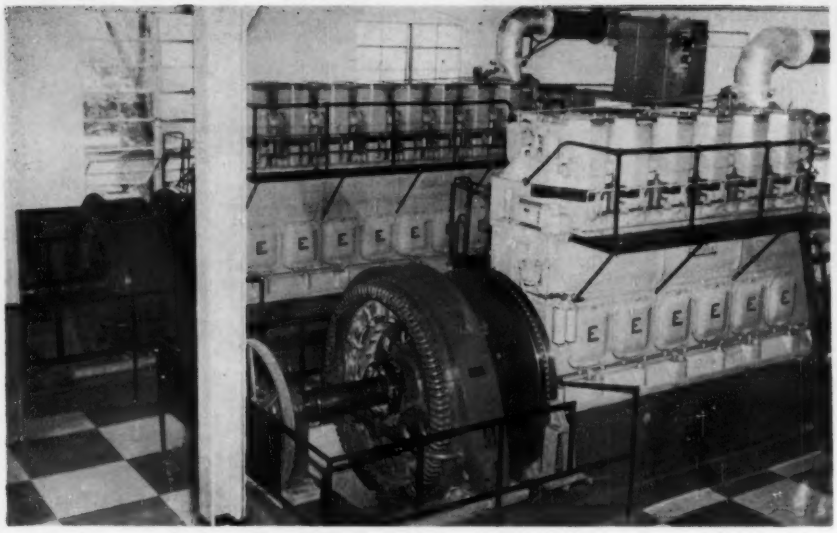
Secondly, superfinishing increases the effective bearing area by removing the layer of smear metal resulting from high grinding temperature. The result is a perfectly smooth surface having the metallurgical qualities originally desired. Surface stresses often also result from the heat of grinding. The crazed, or cracked surface resulting from these stresses are visible many times only after superfinishing.

When used with superfinished shafts, bearings have a more uniform clearance. Proper clearances are essential in determining thickness of the oil film. As this film decreases, the load-carrying capacity of the bearing is greater. The elimination of peaks in the bearing surface permits a thinner but more efficient oil film. This reduces bearing temperatures and increases its life.

Now for some facts relative to the use of the superfinishing attachment. The stone is under a mild, flexible pressure and oscillates rapidly, with the work revolving relatively slowly. The pressure is from 20 to 30 psi; oscillation amount to 3/16-inch at the rate of 800 strokes per minute; the work revolves at a surface speed of 50 to 150 fpm. A lubricant helps the cutting action of the stone and washes away abraded particles.

The stone grit and length of cycle time, can be controlled to produce the desired degree of surface finish. Stones are available up to four inches in length. However, when the work length exceeds that of the stone, a traverse movement is given to the stone or the work.

With this attachment among your tools a high-class job can be done in producing superfinishes on crankshafts. This is done quickly and with a small investment.



A scheduled maintenance program keeps these Enterprise engines at Broken Bow, Nebraska, in top shape, operating efficiently and with the minimum of down time.

Solving Your Plant Problem

By Larry E. Clark
Superintendent of Utilities, Broken Bow, Nebr.

Chances are your particular plant problem is among those discussed in a survey of Nebraska Municipal plants. Analysis of these problems and suggested cures may help you.

WHAT is your power plant problem? Usually there is one or more in every plant which, to say the least is annoying, if not down-right serious. Your specific problem may very well be included in the accompanying table. Take a look. These troubles were tabulated from the answers to questionnaires sent out during a survey of diesel power plant problems in Nebraska.

The following comments are intended to be thought provoking rather than sure cure answers to every problem. Some of these suggested answers were included as part of the comments received with the questionnaires. Particular credit should be given to Mr. John Cramer of Fulton & Cramer, Consulting Engineers, Lincoln, Neb., for some worthwhile ideas which he contributed and are incorporated herein. First to be discussed will be. . . .

Operating Problems

With reference to problem No. 1, the engines won't carry full load, the trouble may be that something has worn excessively, needs cleaning or adjustment. Especially if the engine previously carried its full load, worn rings and/or liners, dirty air cleaner, faulty injectors or adjustment to the fuel system may be the troubles. If the engine won't carry its full load in the summer, intercooling is necessary.

The problem of too much pilot fuel (2) is serious because it costs from two to three times as much as natural gas per BTU. A practical minimum for pilot fuel in most plants is five percent. If the injection pumps are adjustable, each adjustment toward less fuel should be made in small degrees. Then carefully observe the effect, since the smaller the total pilot fuel percentage, the more critical any changes become.

(3) Air-gas ratios are the basic secret of efficient dual-fuel operation and the benefits of having these ratios just right cannot be stressed too highly. Inexpensive equipment such as a gas flow meter will gauge the best possible air-gas ratios.

The fourth problem, regarding excessive lube oil consumption is a factory service problem if the rings and bearings are OK and the lubricator is properly set. In any case watch those leaks.

Increased consumer demand is the foremost reason for the purchase of additional generating equipment. (5). However, in certain cases good engineering reasons may sometimes be the deciding factor when buying new equipment. For example, a new unit which operates on cheaper fuel or fuels and raises the overall plant capacity may be bought to replace an old inefficient engine of smaller rating.

The amount saved in operating and servicing costs may easily pay for the investment in a short time plus the fact that it is more dependable. However, don't go overboard along these lines. In some cases, a really good maintenance program would forestall the purchase of new equipment.

NEBRASKA MUNICIPAL DIESEL PLANTS

Answers to Questionnaire

Problem No.	No. of Plants Involved	
		Operating Problems
1.	2	Engines won't carry full load.
2.	2	Too much pilot fuel.
3.	1	Too much Natural Gas.
4.	1	Too much Lubricating Oil.
5.	12	More generating equipment needed.
6.	7	Intercooling needed.
7.	4	No flow meters.
8.	1	Operators fail to keep engines properly loaded.
9.	1	Pilot oil will not remain constant.
10.	1	More cooling capacity needed.
11.	1	Intercooling water supply & disposal problems.
12.	1	Air filtration problems on large engines.
13.	1	High freight rates.
14.	1	High Gas rates.
		Maintenance Problems
15.	4	Hard to keep load on cylinders balanced.
16.	2	Excessive ring wear.
17	3	Valve troubles.
18.	2	Bearing troubles.
19.	2	Air-gas ratios hard to maintain.
20.	1	Rubber head gasket troubles.
		Safety Problems
21.	6	Operators engage in unsafe practices.
22.	1	Equipment is unsafe to operate.
23.	3	Not enough safety alarm controls.
24.	6	No safety training.
25.	1	Day tank low level alarms needed.
26.	1	Heat exchanger problems in cold weather.
		Factory Service Problems
27.	2	Co-operation poor.
28.	7	Service too expensive.
29.	8	Service too slow.
30.	5	Insufficient maintenance instructions.
31.	11	Scheduled factory service men's trips needed.
32.	6	Operators underpaid.
33.	8	Insufficient local training available.
34.	6	Operators not permitted to attend training schools.
35.	1	Political Interference.
36.	1	Smaller plants need training from neighbors.
37.	1	Conduct of some operators at schools are problems.
38.	1	Cost of training a problem
		Instrumentation Problems
39.	2	Insufficient switch board instruments.
40.	1	Not enough time meters.
41.	4	Not enough gas meters.
		Record Problems
42.	2	Log sheets inadequate.
43.	3	Not enough monthly and other record forms.
44.	2	No standard record forms available.
45.	4	Operators not trained to keep records.
		Financial Problems
46.	2	Excessive Debt.
47.	1	Service Rates too low.
48.	3	Production costs too high.
49.	7	Fuel costs excessive.
50.	1	Better audits needed.
51.	1	Better control and accounting for free services rendered.
		Public Relations.
52.	1	Public unfriendly to plant.
53.	12	Public not adequately informed.
54.	1	City officials un-cooperative.
55.	5	City officials not adequately informed.
56.	1	Highline propaganda.

read Larry's "little things Cut Costs" Diesel Power, April 1955

any salesmen listening?

Preventive maintenance may be the cure

better correct before some one gets hurt. It may be you

We've said so for years. amen ! ! !

a Football — even a political one - gets kicked around.

you'll save more than you pay for them

can't tell the players without a score card

Increase operational efficiency

This is very important. Do a good job and let people know it.

Municipal power plant at Broken Bow, Nebraska, where Mr. Larry Clark successfully practices what he preaches.

When intercooling is needed (6), the equipment should be bought. There's no way of getting around this problem, unless operation of the unit at reduced load can be tolerated. In the first place this can't be done in many cases and secondly, it increases the operating costs.

Relative to problem No. 7, no flow meters, the disadvantages of this have been discussed above. They should be built or purchased.

Where operators fail to keep the engines properly loaded, (8), operator training is the answer. The ill effects of overloading, and operating an engine for long periods of time with too light a load, should be impressed on the operators. Show them how the money saved by proper loading may affect their salaries.

Since the problem (9) of keeping constant the pilot oil is peculiar to only one manufacturer's engine and is probably a service problem, the manufacturer should be consulted.

If the present cooling equipment is properly maintained and in good condition, and still the engine cannot be adequately cooled, (10), additional cooling equipment must be bought.

With reference to air filtration problems (12) on large engines, enough can't be said to stress the intake of clean air in any engine to prevent excessive wear of rings, pistons, liners, valves, etc. Large engines, especially in the western part of the state, require motor-operated self-cleaning filters.

The problems of high freight rates and high gas rates (13) (14) require the combined efforts of an organization to have any effect on lowering costs. In the meantime, keep the gas consumption down by more efficient operation.

Maintenance Problems

Keeping the load on cylinders balanced, is a problem (15) which can be overcome by a scheduled maintenance program for the injection equipment. This, plus the use of a cylinder pressure indicator and a close check on a pyrometer corrected in accordance with the pressure indicator, should aid in keeping cylinders balanced, if the engine is in good condition.

The problem of excessive ring wear (16) can be solved by correct timing, scheduled maintenance, clean oil, clean air, power oil control rings, clean parts, proper lubricator adjustment and freedom of water and fuel leaks in the cylinder.

The foregoing goes for the valve and bearing troubles mentioned in problems 17 and 18. In addition, the alignment of bearings should be regularly checked and recorded. Also, the problem should be referred to the factory for further recommendations.

Air-gas ratio problems (19) may be aided by the use of auxiliary air controls and flow meters as previously explained.

Rubber head gasket troubles (20) are sometimes caused by oil or fuel leaks. Neoprene gaskets may be the solution.

Safety Problems

Operators engaged in unsafe practices (21) should have impressed upon them that not only are they endangering the equipment and other peoples lives but also their own. Safety training locally and in training schools is a must (24) if unsafe practices are to be eliminated.

Relative to the problem (22) of equipment unsafe to operate and lacking safety alarm controls (23) it should be made safe without fail. Although this may be a factory problem, those working on the job and who are responsible should insist on having these conditions corrected at once. Enough safety controls should be installed on the engine when it is purchased. However, if they are not, see to it that they are put on immediately. Again, scheduled maintenance and safety training may be the answer.

Since some dual-fuel installations have small day tanks, (25), low-level alarms should be installed. A change to full diesel operation can quickly empty these

tanks. Also, the loss of pilot fuel oil supply can mean an explosion.

Problem No. 26 deals with heat exchanger troubles in cold weather. Automatic controls on the heat exchangers in some diesel installations can cut the flow of water through the radiator so low that freezing may result in very cold weather. Bypasses, shutters or warning system should be provided.

Factory Service Problems

Factory service problems (27) can best be solved by the factory's understanding of your needs. Engines, like human beings, need case histories in order to be doctored. The factory can be the most helpful (29) when you operate on a scheduled maintenance program and (31) adequate records. Also, the factory man can see exactly what has been done, and concentrate only on the immediate problem. Factory service trips will then be fewer in number, and less expensive (28).

Personnel Problems

Good relations with the public and city officials will aid in solving many operators problems. Most city officials will be reasonable in the matter of pay (32) and training (33) when they understand the need. One excellent source of information and data is from the various DEMA educational meetings which may be held in any of your local plants, shops or schools. As a last resort, if a training school can't be attended (34) get your information from instruction books, engineering hand books, or good technical magazines. Also if possible, try to get in on any training being given at one of the nearby power plants (36).

The problem of political interference (35) will usually melt when it is proven that a good job is being done.

The problems of training expense (38) and operator conduct (37) when at school have been aggrevated by some operators themselves. Some operators have abused the privilege of attending training courses and conventions. Poor practices by a few have worked a hardship on many others. If city officials are to pay for the expenses and time of an operator who attends a training school, they are entitled to some benefits. They are also entitled to know that an operator's conduct will be becoming to their city and that the same energy will be applied in acquiring training that is applied when doing their jobs at home.

Some few operators have given the impression that they have gone for a vacation or good time. Others have viewed training contacts as an employment agency or as a means of obtaining a higher salary. Contacts are made to learn where higher salaries are paid or the position is more lucrative. Instead of waiting to apply the training received and make themselves more valuable in their own jobs, they immediately bring pressure for more pay. One such abuse can keep every operator in a given city from attending training for many years.

A code of self discipline should be adopted among operators themselves, to solve this problem. The cost of training will cease to be a problem when the employer is sure he gets his money's worth and 95% of them get more than their money's worth now.

Instrumentation Problems

As previously mentioned, instruments, where needed, (39) (40) (41) are money makers and should be purchased. This is especially true when the safety of the equipment or the personnel is at stake.

Record Problems

Plants with fine records can serve as models to develop records for other plants. Smaller plants can probably develop suitable standard forms through an organization (43) (44). No matter how it is done, accurate records are a must (42) (43) if a plant is to be operated efficiently and with a minimum of confusion, especially relative to a progressive maintenance schedule.

Financial Problems

Financial problems (46)-(51) usually stem from five causes. These are: low rates, inefficiency in production, wasteful distribution, excessive fuel costs, and low volume of sales. Efficiency in production should receive first attention through scheduled maintenance and records. Give-away programs of free services and materials should be checked by proper audits and then controlled. The use of cheaper fuels should be investigated. If these fail to provide enough additional earnings, service rates should be increased.

Public Relations

If a good job is being done and the public is adequately informed, (53), public relations will usually be favorable (52). Municipal plant information and highlights made public through local newspapers and/or through good annual reports by the plant supervisor, are invaluable. They keep the city officials (55) as well as the public, well advised of all the benefits derived from the power plant. In many cases the mystery can be taken out of the plant operation by holding an open house and inviting the public to visit the plant for a brief explanation of its operation. Generally, both the officials and public will be more friendly toward something they have seen and understand (54) (56).

Conclusion

Of course the above comments are not intended to be sure cures for every problem cited. Rather, they are intended to stimulate thinking and make you figure out the answers to your specific problems or at least encourage you to discuss these troubles with others who may provide the answers. It is also intended that you be spurred into action which will be reflected in more efficient and safe plant operation and better all around relationship. If these results are obtained, the mission is successfully accomplished.

Railroad Shop Hints

Original ideas from the man in the shop often turn up in the form of time- and labor-saving tools. Following are a few ideas straight from the shops of several railroads.

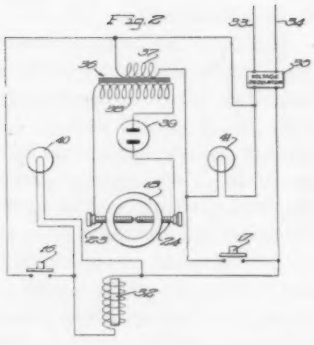
IN any diesel shop, you will find certain tools which are just not available from the tool houses. The man in the shop is sometimes a step ahead of the tool manufacturer and has a need for a tool which will cut the time necessary to do a job and produce the desired result. In most cases these tools or fixtures are developed and fabricated right in the shop by the men who got the original idea.

In some cases, some of these ideas become commercially available after their development and trial. Now, let's take a look at what the man in the shop has come up with on just a few railroads—to save time and labor.

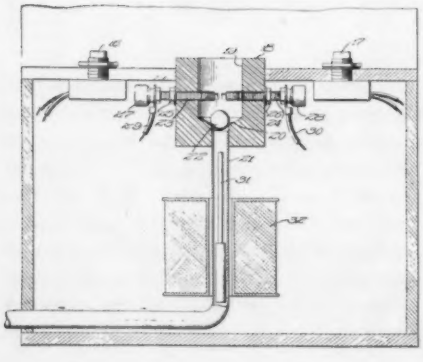
Water Detector

Originated in the test department of the Gulf, Mobile & Ohio Railroad, this device was patented and was later taken over by an electric specialties concern.

It was designed primarily for on the spot use, for quickly detecting the presence of water in crankcase oil samples. This affords a method by which a considerable number of samples may be tested daily, by personnel comparatively unskilled in laboratory practices.



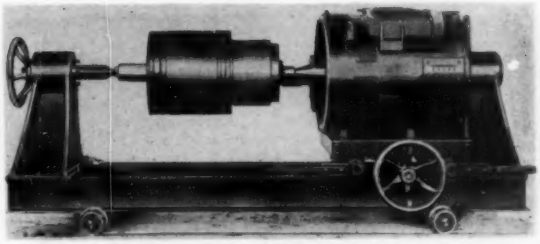
Samples taken on arrival at maintenance or layover points, can be processed within a matter of a few minutes and the test results made available immediately to maintenance force supervision. This gives an opportunity to make repairs to stop water leaks, and to make oil changes if necessary before the locomotive unit is dispatched. It eliminates many risks of road failures and engine damage, due to water in lubricating oil in dangerous proportions.



The principal parts are as follows: A receptacle 18 made of Lucite, with a drain pipe 21 at bottom connected to a vacuum pump (not shown), and a ball check 22 which seats on port 20 except when plunger 31 through energization of solenoid 32 during drainage of receptacle; an electrical system consisting principally of a transformer 36, with a primary winding 37 fed by a 110 volt circuit lines 33 and 34 through a voltage regulator 35, and a secondary winding 38 which is wired in series with electrodes 23 and 24 neon glow lamp 39, together with push button switches 16 and 17 and their indicating lights 40 and 41 respectively.

This water detector is adaptable for use in determining water content in other petroleum products besides lubricating oils, such as fuels—diesel fuel oil, kerosene, and other relatively non-conductive liquids.

Traction Motor Armature Extractor

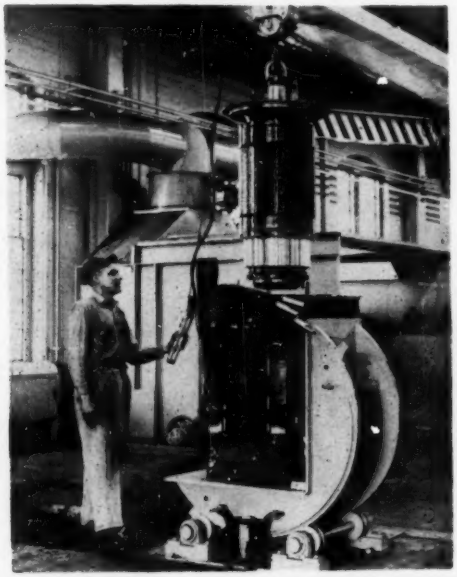


Performing much the same functions as the Up-Ender, this device is on an older design. In operation, the complete motor is placed on the movable table, which is adjustable in height, and the armature in the motor centered from the points of the tool. After the removal of the armature shaft bearings and parts, motor end cover brushes and holders, the entire assembly is moved toward the long stationary center until end of armature shaft is picked up by center. Then the adjustable center is moved out to engage the other end of shaft. Now with the armature carried between the centers, the motor frame is moved to the right. Thus the armature is quickly removed from motor frame without damage to either armature or fields.

This armature extractor was later redesigned, providing fixtures on top of the carriage for supporting the motor frame on its suspension bearings (caps removal) and on motor support lug. By means of an adjusting screw the motor is raised or lowered slightly to bring the centers in ends of armature shaft in line with the centers of extractor.

These extractors may be mounted on flanged wheels, as shown, or mounted permanently in an electric repair shop where work is brought to machine by overhead crane.

Traction Motor Up-Ender

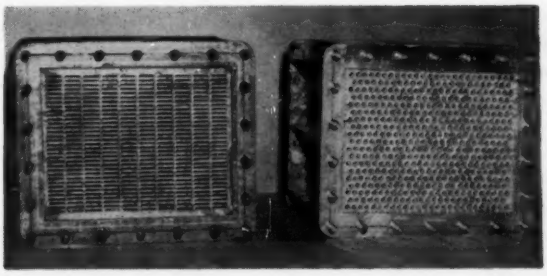


Here is an example of a device which was originated in a railroad shop and later taken over for commercial production by an electric manufacturing company. In the horizontal position, some preliminary dismantling is done, such as the armature bearings and parts, frame end casting, commutator brushes and holders (if necessary). Then the machine is rotated 90 degrees from which position the armature may be lifted out vertically by a crane. Assembly of course, is in the reverse procedure.

The unit is electrically operated by a geared reduction motor, with push button control and limit switches. A safety feature against overdrive is provided.

The entire unit and controls are mounted on a heavy plate base which can easily be relocated in the shop, as no foundation or fastening to the shop floor is necessary. Where volume of work justifies one Up-Ender can be used in disassembly area, and another in reassembly area.

Lube Oil Cooler Modification



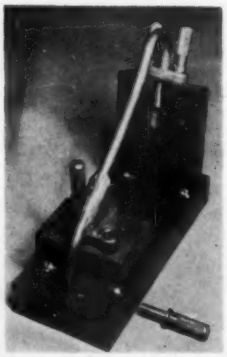
During a material shortage, Seaboard Air Line personnel were unable to get the standard flat tubes as originally furnished in EMD lube oil coolers. The problem was solved by resourceful shop personnel with the use of 485 $\frac{3}{8}$-in copper tubes having a wall thickness of $\frac{1}{8}$-in. These were soldered to new end sheets. Spirally twisted inserts of light sheet metal were placed in each tube to provide greater cooling efficiency. The modified cooler proved satisfactory in service.

Monorail & Hoist Facilitates Handling

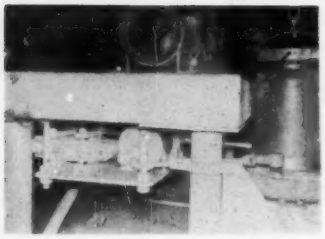
Recently installed at Reading, Pa. Shop on the Reading the monorail serves an area where power assembly parts are reconditioned. Its hoist saves considerable labor in handling parts, such as cylinder heads, pistons, liners, and connecting rods. Also it expedites the entire repair program by releasing the large 10-ton overhead crane, serving this bay for its entire length, for work in other sections of the shop. Most of the material and parts for this tramway and its equipment were obtained by salvage from obsolete and discarded facilities.

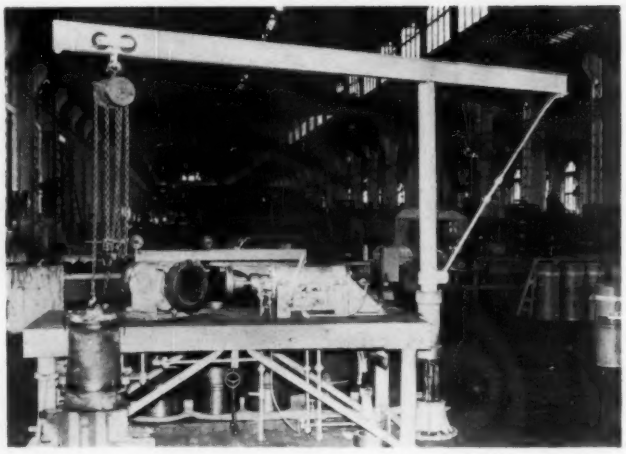
Alignment Gauge

This gauge block/is for checking alignment of EMD, PEE pipes. About the only straightening done is to bend pipe slightly to bring nozzle into line, so that the piston cooling oil jet will register exactly with hole in piston carrier at the bottom end of piston stroke. Misalignment is usually negligible, but it may be just enough to split the oil stream and thus destroy its efficiency. No effort is made to straighten PEE pipe at either fitting, as this might make realignment more difficult and possibly result in pipe damage.



Liner and Water Jacket Stand



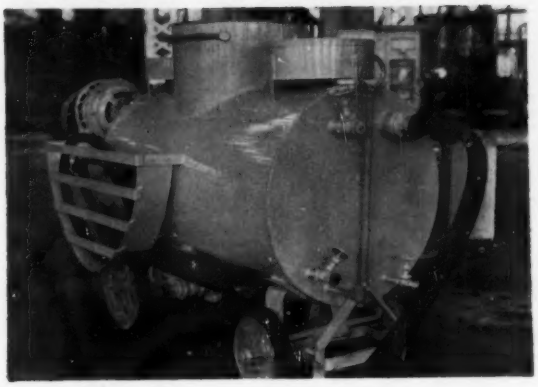


In a jig on top of the stand a hydraulic cylinder pushes a cylinder liner into its water jacket. Dismantling of liner and water jacket is by a reverse procedure.

A unique arrangement for grinding cylinder head to its seat on cylinder liner (there is no gasket between these two parts on Alco units), is located underneath the stand. A mandrel for supporting the head is pivoted to one leg of stand, around which it is swung out into position to receive head. The weight of liner on top of head (both upside-down) is sufficient to facilitate the grinding of the common seat (or joint). The oscillating movement, common to this sort of grinding job, is imparted from a crank on a short shaft which is revolved by power from spindle of an old close-quarter air motor.

Starting with grinding compound between head and liner faces, it is occasionally necessary to lift liner and apply additional grinding compound. This job ordinarily rather laborious when done by hand, is accomplished by use of this device in record time and with a minimum of labor.

Flushing Tank



A Mobile tank for flushing Alco engine lubricating oil systems, consists of a 300-gal solution tank, electric pumping outfit and hose mounted on a shop wagon.

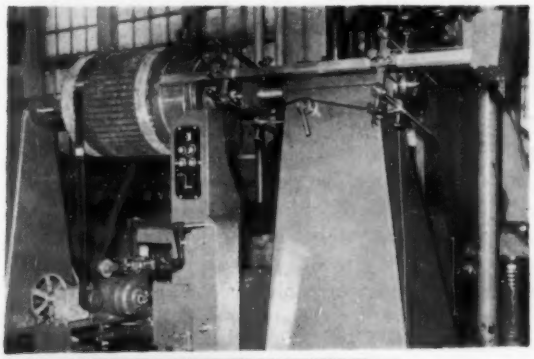
Procedure for this periodic lube oil system flushing, including the oil cooler, but with engine blocked off, is to start pumping with a cleaning solution made up of 100 lb Oakite 24 and one gal Oakite 11 to 300 gal of water at a temperature of approximately 180°F., and continue recirculation of this solution for about four hours.

The system is then rinsed with hot water starting at 180°F., circulated until water temperature is reduced to 50°F. An inspection to determine cleanliness of the oil cooler tubes follows and then re-refined lubricating oil is pumped through system for about one hour. The purpose of this is to thoroughly flush the cleaning solution from the lube oil system.

(Note: This procedure is primarily to clean the oil side of the oil cooler).

Pumping equipment is an ALCO water pump, driven by a 10 hp electric motor, taking current from a shop line.

Commutator Undercutter



Another example of a machine first developed in a railroad shop and now commercially available is this heavyduty, automatic undercutter. It is designed to handle armatures of up to 60-in diameter with commutators ranging in size from 10 to 42 in.

Featured on this machine is a sensing head which makes the machine fully automatic. The basic principle on which the automatic sensing device operates is that a circuit is established through the commutator by employing a carbon brush which spans a number of bars for establishing a common contact.

A pointed element bearing on the commutator surface is designed to break a relay circuit when, with the armature turning, a mica segment passes under the point. With this circuit broken, the armature rotating motor is stopped. The armature is stopped in a position which brings the mica segment in line with the saw.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 99 to check them.

1. One danger of attempting to run-in a rebuilt engine without load is that—
   a. Lubrication may be inadequate
   b. Liner may glaze before ring seating occurs
   c. Ring wear may be excessive

2. The most critical period for a rebuilt engine that is being run-in is—
   a. Right at starting
   b. During preliminary warm-up
   c. The first few hours of operation under load

3. If a dynamometer will handle one 300-hp engine, it will handle any 300-hp engine.
   a. True b. False

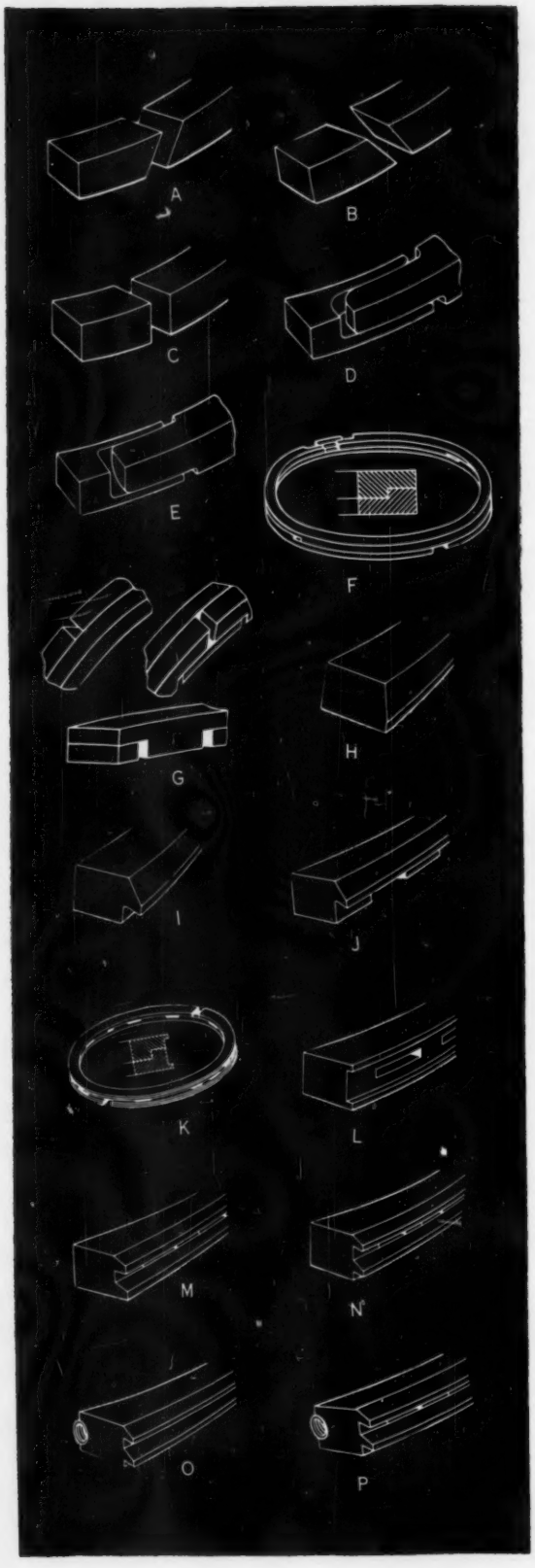
4. Probably the major factor in obtaining efficient dual-fuel engine operation is—
   a. Maintenance of proper air-gas ratios
   b. Having the minimum amount of pilot oil
   c. Control of excess air in cylinders

5. In rebuilding engines you should always stick to the same piston ring set as originally supplied.
   a. True b. False

6. Valve breakage at the juncture of head and stem is caused by high seating impact. One reason for this is .....valve spring tension. Select proper word.
   a. High b. Low

7. The principal cause of valve face failure is—
   a. Excessive temperature
   b. High impact
   c. Mechanical abrasion

8. Valve faces may show localized cracks or where these meet, sections may have broken out. Principal cause for this is—
   a. High seating impact b. Blowby
   c. Abrasion



Selecting Ring Combinations

By D. D. Cook, President
Daros American Corp.

Compression pressures have a major effect on engine efficiency. Proper selection of piston rings will help maintain correct compression pressures. The author's recommendations for selection of piston rings are given.

CURRENT trends in the internal combustion engine industry are toward higher cylinder pressures and faster engine speeds. The goal—greater efficiency, lower weight per horsepower, and reduced costs.

Almost all industrial diesels now use cylinder pressures approaching 1000 psi, with some supercharged versions reaching peak pressures as high as 1600 psi. These higher pressures make it necessary that the operator have a clear understanding of several factors which affect compression pressures as well as firing pressures, and their influence on diesel efficiency. Unless these higher cylinder pressures are correctly maintained, the efficiency curve will take a nose dive and the maintenance cost curve will take off in the opposite direction.

When operating with a fixed maximum fuel volume, a 40-psi compression pressure loss will be reflected by a 60- to 80-psi firing pressure reduction, followed by a reduction in horsepower output per unit of fuel consumed. When operating with a fixed maximum load and experiencing a similar loss in compression, an increased amount of fuel will be required to maintain the amount of firing pressure essential to produce a given power output.

For example, in a test engine with identical operating conditions, except for the difference in compression pressures, with 100% load and variable fuel supply, fuel consumption increased as follows: (Fig. 1)

Reduction in Compression Pressure	*Increase in Fuel Consumption*
10 *psi*	5¾%
20 *psi*	8½%
30 *psi*	10½%
40 *psi*	11½%
45 *psi*	11¾%

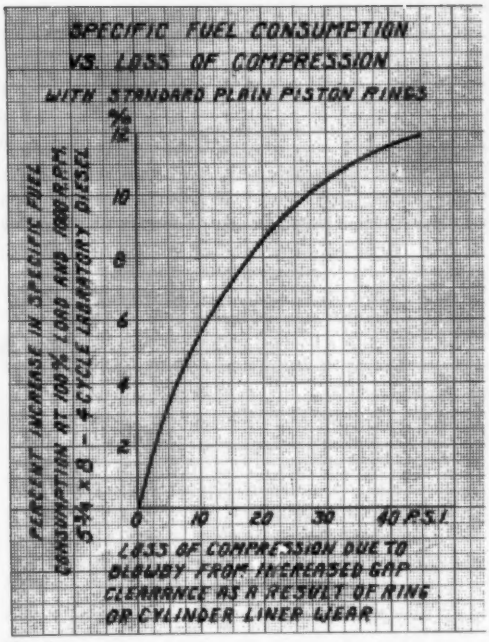


Fig. 1

With a fixed maximum fuel volume and variable load, there was a corresponding loss in power output per unit of fuel consumed. It was interesting to note that the first 20-psi compression pressure reduction caused a greater economy loss proportionately than the next 30-psi pressure drop. This should confirm the value of maintaining compression pressures as close to those of a new engine as possible.

What Changes Compression Pressures?

There are several factors which affect compression pressure, including change in engine speed; variation in intake air density, as affected by temperature or altitude; and change in compression ratio; but we are going to talk about cylinder leakage. There are three places at which the latter most generally occurs. These are: (1) between the cylinder head and the top of the liner; (2) past the valves; and (3) down past the piston rings.

Leakage down past the piston rings can occur at three different places (Fig. 2). These are; at the point of ring-to-wall contact; ring-to-groove contact; and through the ring gap.

A close inspection of rings will reveal whether leakage has been occurring at any of these points. Where old rings with correct tension show a well-polished surface around their entire circumference, little or no leakage has been occurring between the ring and cylinder wall. On the other hand, if the ring has become badly worn and lost its initial tension, it may collapse during pressure strokes and excessive leakage will occur between the ring face and the cylinder wall and yet still show a reasonably good polish. The latter may be acquired at the lower portion of the stroke.

Where rings show black or discolored areas across the face, this indicates poor circularity. Excessive leakage will occur where the ring fails to contact the cylinder wall during any portion of the stroke. Lack of circularity can be caused by distortion during application or improper manufacture.

With pressure flowing around behind the ring, the ring-to-groove contact area is just as important as the ring-to-wall contact point. An inspection of the lower side of the rings will indicate groove condition and whether leakage has been occurring at this point. Again, we are looking for a bright glaze or discolored areas across the full contact area.

If the ring land has been worn, then the ring may have a polish only on its inner portion where it has been contacting part of the land. The lower surface of the ring should always be inspected for condition as increased groove wear usually occurs when operating with excessively worn rings.

Should new rings, having full radial thickness, be installed in a worn or shouldered groove, proper contact is not made between the ring and the lower working surface of the groove. Such installations can result in ring breakage, especially of the top ring due to insufficient support.

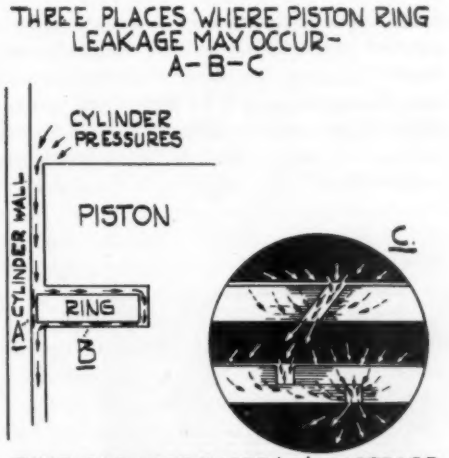


Fig. 2

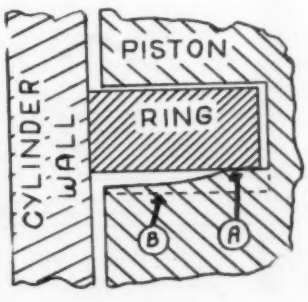


Fig. 3

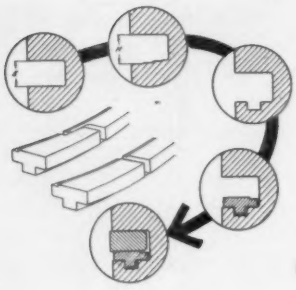


Fig. 4

Worn ring grooves (Fig. 3 & 4) can be remedied by cutting away the worn area and either installing wider rings or installing ring groove inserts. The latter make up the difference, permitting the use of rings of standard thickness.

The end gap of the ring is the third point at which leakage can occur. This provides a natural path for leakage. The gap is at its minimum when rings are new. However, as rings and liners wear, ring end gap increases at the direct ratio of 3.1416 multiplied by combined diametrical ring and liner wear (Fig. 5)

With maximum cylinder tightness being required at the high-pressure end where the greatest cylinder wear has produced the maximum ring gap opening, this accounts for excessive leakage where the open-joint rings are used alone. This condition cannot be corrected by simply installing "over-size" diameter rings. The minimum allowable gap will be determined by the minimum cylinder bore which is below the area of maximum wear. So much for what to look for—now which rings should be used where!

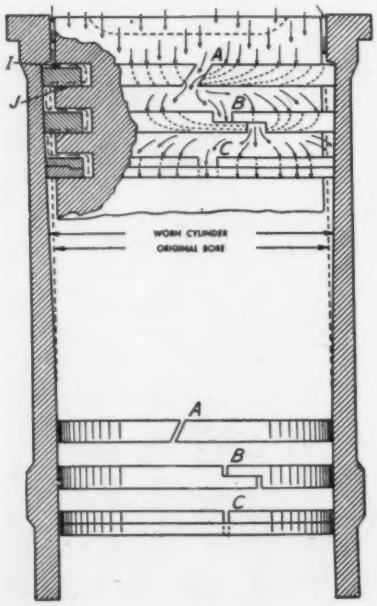


Fig. 5

Selection

DaRoS recommends the use of sealing rings for best engine efficiency. The simple, plain angle or butt-type ring ("A", "B", and "C") is commonly used in the original factory assembly by equipment manufacturers. When used in new or nearly-perfect cylinders, it renders good service. The rate of leakage at the gap as previously mentioned, while small when initially installed, gradually increases with radial wear. Thus, the longer a plain ring (when used alone) is operated, the less efficient it becomes.

In diesel service DaRoS has found that best results are obtained by using a combination of plain rings in the upper grooves together with two or three sealing rings in the lower grooves.

Cylinder condition will influence recommendations as to ring style. In new cylinders or where less than 0.001-in variation per inch of diameter exists, sealing rings "D" or "E" are recommended. When installed in badly worn cylinders however, there is a possibility that breakage of the sealing tongue pieces may be experienced. Therefore, in worn cylinders, sealing rings "F" and "G" are recommended. These rings have shown their ability to work successfully even where cylinder wear of as much as 0.005-in to 0.010-in taper per inch of diameter is present.

In 2-cycle engines, where ring breakage is sometimes experienced due to ring ends catching in the scavenging ports, ring "F" is recommended. However, if ring breakage in 2-cycle engines is due to faulty ring grooves, incorrectly adjusted fuel timing, or from faulty injection equipment, it then becomes essential to consider these other factors in addition to selecting the correct sealing ring.

In selecting oil control rings it is necessary to first consider the fact that all rings work as a team. Thus, the combination of compression rings used enters into oil ring selection. Where compression rings have good oil control characteristics, such as the taper-face, sealing, or twist ring types, less effective oil control rings may be all that are necessary for good oil control and adequate oiling of compression rings. Likewise where oil control characteristics of the compression rings are poor, more effective oil control rings will be necessary.

An oil ring with a narrow single bearing contact or only one scraping surface is more effective due to higher wall pressure, than an oil ring with two or more scraping edges. Hence, rings "H", "I", "J", and "K" are more effective than oil rings "L", "M", and "N".

Ring "K" consists of two separate rings in one groove. While it has two surface contacts with the cylinder wall, its unit wall pressure is much higher than that of rings "L", "M", and "N" which also have two scraping edges but are made as solid, 1-piece rings.

The combination of rings shown in Fig 6 is a typical of that recommended for a 4-cycle engine with this groove arrangement. The first two grooves are fitted with plain rings "A", "B", or "C", followed by two "G"

sealing rings. In the fifth groove, oil ring "H" is shown. Oil ring "I" is used in the sixth groove. This ring is not vented since the vent holes are below the groove.

In the two lower grooves, vented oil ring "J" is used. This combination is designed to produce good lube oil economy and is recommended when sealing rings are used. Where only plain, open-joint compression rings are used, then ring "H" is recommended.

Should greater economy be desired than that obtained

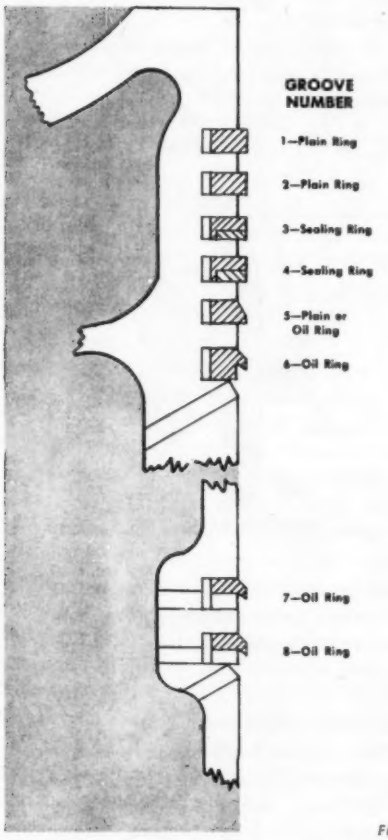
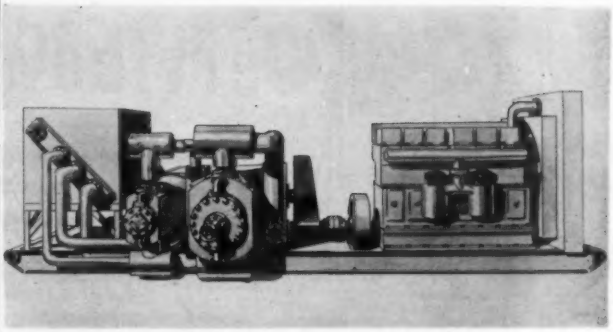


Fig. 6

from the combination of rings shown in Fig. 6, it can be accomplished in one of the following ways:

1. Substitute oil rings "K" for oil rings "I" and "J".
2. Use the same style oil rings as shown but substitute tool steel for cast iron, which is standard material.
3. Substitute spring-loaded oil rings "O" and "P" for "I" and "J" as shown.

Operators should be cautioned against the use of three or more extremely effective oil rings per piston, as this could easily result in inadequate lubrication, followed by scored pistons and cylinder liners.



Air cooler, compressor and engine form skid-mounted mobile unit.

New Air Compressors For Well Drilling

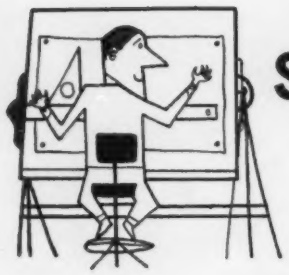
WITH gas and oil exploration going deeper and deeper, accelerated use of air in drilling is now foreseeable. Utilization of compressed air is being forecast to eliminate many of the high-pressure problems created by heavy water columns on drill bits and rock formations. Under such conditions, the drilling characteristics of certain rock formation are becoming increasingly difficult to handle.

Contractors are also finding that it is advantageous to be able to use either air or mud or a combination of the two to speed their operations. They are presently making use of compressed air as an alternate to mud for cooling the drill bit and clearing rock chips.

Clearing clogged bits or blowing water-slugged holes call for pressures up to 1000 psi. Cooper-Bessemer Corp. has assembled a line of heavy-duty compressors which deliver up to 1500-psi air pressure. They are skid-mounted packages which can be moved around easily with the drill equipment. Operation power may be obtained from the existing drill unit draw works or from individual prime movers.

When operated from the conventional draw works power takeoff, the compressors take their power by a vee-belt pulley. As such takeoffs generally furnish up to 1500 hp, which is used only when pulling the drill string, there is always ample power for driving the air compressor during actual drilling. Normal drilling requirements approximate 2000 cfm air at 250 psi.

In its development work on a compressor for air drilling, Cooper-Bessemer engineers stressed reliability of operation. And as a result of the experience gained in the design and manufacture of gas compressors and industrial air compressors, the new air drilling compressor units feature rugged bearings and pistons.



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

I-H—Inspection of Vibration Dampers—UD-16, UD525, U-1091 and UD-1091 Power Units, TD-18A and TD-24 Crawler Tractors . . .

It is suggested that at any time the above model engines are down for overhaul, or when a new crankshaft is to be installed, that the vibration damper be inspected for breaks or for signs of a poor bond between the rubber and the metal portion of the damper.

If either one of these conditions exist, it is suggested that the vibration damper be replaced.

DETROIT DIESEL—Generator Drive Hub Service Oil Seal Spacer . . .

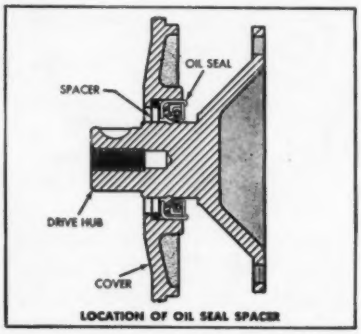
A service ring-type oil seal spacer has been released for use with the generator drive hub oil seal on Series "71" engine units which employ a belt-driven generator—the generator being driven by a drive hub bolted to either the camshaft or balance shaft gear.

Over extended periods of engine operation, the generator drive hub may become worn at the area of contact with the lip of the oil seal and thus render the seal less effective. When this wear, which will be in the form of a shallow groove, reaches the point where the effectiveness of the oil seal is lost, the oil seal spacer and a new oil seal should be employed.

The spacer is installed against the shoulder of the counterbore in the cover, as depicted in the accompanying drawing, and serves to reposition the seal, thus providing a new sealing surface for the lip of the seal on the generator drive hub.

During an engine overhaul, the generator drive hub should be inspected to determine the amount of wear that has taken place. If the hub is grooved at the area of contact with the lip of the seal, a spacer should be employed to reposition the seal, and a new oil seal installed.

Use of the oil seal spacer will permit the continued use of the generator drive hub thereby effectively lengthening its serviceable life.



LOCATION OF OIL SEAL SPACER

EMD—Trunnion Type Piston Carrier And Pin Wear Limits And Cleaning Procedure . . .

Recent studies of the trunnion carrier have indicated that the method of measuring wear in the carrier bore, outlined in Maintenance Manual 252C, can be improved.

In Manual 252C carrier bore wear measurement was stated in maximum allowable out of round. However, an out of round condition can exist in the closed ends of the bore independent of wear. In order to eliminate this source of error, measurement of carrier bore wear is to be made by measuring distance from top of carrier bore to platform face on each side.

It will be noted that in addition to the carrier bore condemning limits listed below, new limits have been established for several other carrier dimensions.

Condemning Limits

Trunnion Type Piston Carrier

1. Carrier — top pilot dia. Min. 3.556
2. Carrier — bottom pilot dia. Min. 7.479
3. Carrier height (platform to bottom) Min. 5.990
*4. Top of pin bore to platform:
   a. When re-using same pin Min. 0.690
   b. When interchanging pins or using new pin Min. 0.700
5. Top of pin bore not parallel to platform face. Max. 0.003

*Note: These limits assume no wear on carrier platform. If carrier height (5.997 new) indicates platform wear, the amount of wear can be subtracted from 0.690 and 0.700 accordingly.

Example No. 1:

When re-using old pin:

Carrier height	5.997
Top of pin bore to platform—	
One side	0.691
Opposite side	0.693
Pin bore to platform out of parallel	0.002

In this case, the carrier height of 5.997 indicates no wear on platform so no correction need be made to the 0.691 and 0.693 dimensions. The difference between the pin bore to plat-

(Continued on Page 88)

news of our industry

Ultrasonic Flaw Detection

In the same general way that radar penetrates fog, ultrasonic detecting devices allow you to "see" inside solid materials. The principle of operation involves transmission of short impulses which are beamed through the object under test and reflected back when they strike the opposite surface or any discontinuity in their path. A cathode ray tube screen indicates the reflection.

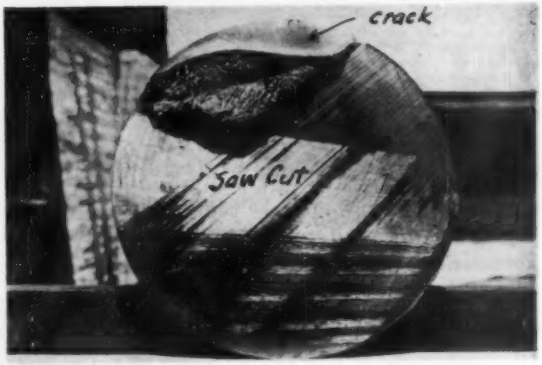
The shape, location, and extent of internal flaws are determined by the path of the impulses, their angle in relation to the surface of the material under test, and the time lapse between input and reflection.

Sperry Products, Inc. has developed these units to a high degree. For the use of those whose testing requirements may not warrant purchase of units and training of operators, Sperry offers both field-testing and laboratory-testing services. Use is made of portable instruments —the Reflectoscope to test defects, and the Reflectogage to measure material thickness.

Railroads have been using ultrasonic equipment for years in rail testing. A division of the company, Sperry Rail Service, employs trained men in test-equipped detector cars to spot irregularities in rails while moving over them. Early detection cuts costs and improves safety by maintaining sound rails for today's heavier loads and greater speeds.

A more recent application for the ultrasonic technique has been found for testing diesel engine parts, car wheels, and axles. In-place inspection of diesel axles during the lengthened intervals between truck disassemblies is being employed as an important safety check. A specially designed Reflectoscope with angle search units has been developed to test high-stress areas.

The top picture shows the instrument mounted on a dolly so that the operator may move the search unit around the periphery of an axle and watch the reflected pattern on the screen. What he might have found is shown below. Due to overheating and damage, this diesel axle developed a crack in the dust guard fillet. If this critical axle had continued in service, a failure would have been certain to ocur which might have been the cause of a serious accident.



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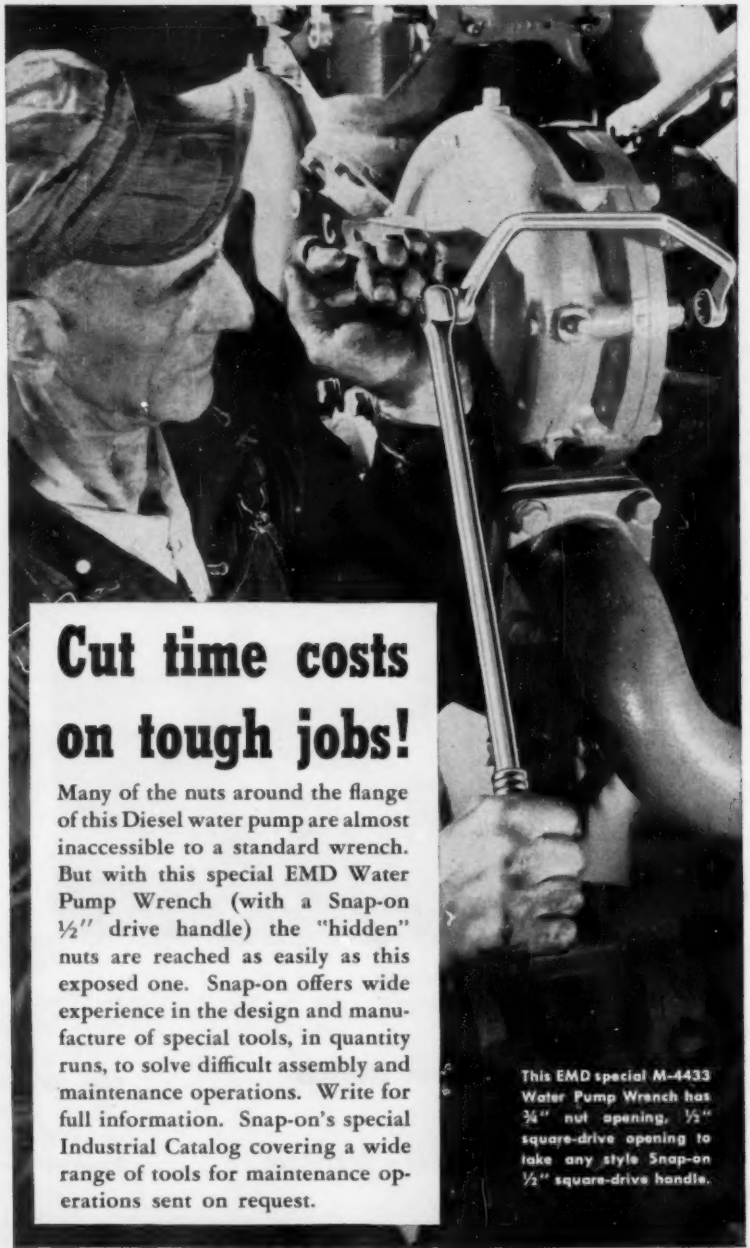
organizational news . . Page 86

Snap-on* Tools



Cut time costs on tough jobs!

Many of the nuts around the flange of this Diesel water pump are almost inaccessible to a standard wrench. But with this special EMD Water Pump Wrench (with a Snap-on ½" drive handle) the "hidden" nuts are reached as easily as this exposed one. Snap-on offers wide experience in the design and manufacture of special tools, in quantity runs, to solve difficult assembly and maintenance operations. Write for full information. Snap-on's special Industrial Catalog covering a wide range of tools for maintenance operations sent on request.

This EMD special M-4433 Water Pump Wrench has ¾" nut opening, ½" square-drive opening to take any style Snap-on ½" square-drive handle.

*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION

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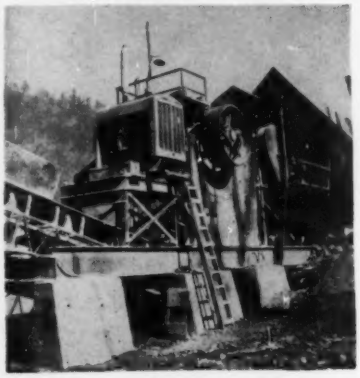
news of our industry



Eccentric Rock Crusher

This is a power view of what is believed to be the world's largest overhead eccentric-type Pioneer 42 by 48 primary jaw crusher. R. B. Taylor Co. and Breslin Construction Co., Louisville, Ky., are its owners. A 275-hp Model NHPS-600 Cummins diesel supplies the operating power for the giant. One of the many projects in which it has seen service was the West Virginia Turnpike. Capacity of the crusher is 450 ton per hr.

Mexican Rails Receive F-Ms

Completed delivery of six 1600-hp diesel-electric locomotives to the Ferrocarril Chihuahua al Pacifico for use in northern Mexico, has been announced by Fairbanks, Morse & Co. The purchase is stated as the first major step in the dieselization of the railroad, undertaken in line with a rehabilitation program to modernize the entire Mexican rail network.

A modern diesel shop is being constructed at La Junta to provide servicing and maintenance facilities for the new units.

Enterprise Air Force Contract

Enterprise Div. of General Metals Corp. announces that the $1.5 million order awarded to it for the U. S. Air Force bases in Spain will consist of large 6- and 8-cyl diesel engines with electric generators. The generator sets will be the sole source of electric power for the bases, giving them independence from local sources. The bases are located at Torrejon, San Pablo, Zaragoza, and Moron.

news of our industry

Cap Screw Selection Advice

Because assembly cost often counts more than the purchase price of the fastener, designers and purchasers should look to the assembled cost in selecting fasteners, Russel-Burdsall & Ward, fastener experts, advise. In selecting cap screws, for example, compare heat-treated and bright finish types on basis of physical properties.

The color of cap screws signifies their physical properties. Bright cap screws get their color and shiny appearance from cold working. Black cap screws with three radial dashes on top of the head get their color from high-carbon content and heat treatment.

Heat-treated cap screws stay tighter, it is pointed out. Holding power of a fastener depends on residual tension which is dependent on tensile strength. If joints are loosening, often the cure can be found in black heat-treated cap screws, tightened to set up the correct residual tension. Their initial cost is greater, but they can cost less than bright ones if holding power is important. For example, to obtain a safe working load of 2 ton, you can use a $\frac{3}{4}$-in bright cap screw or a $\frac{5}{8}$-in black cap screw. The smaller screw costs less.

Correct use of the screws in designing new equipment often permits reduction in size and number of fasteners and holes.

B&M RR Completes RDC Order

With delivery of its 64th RDC unit, Boston & Maine Railroad has become the world's largest user of self-propelled rail diesel passenger cars. The Budd units are now in service on the 114-mi run between Boston and Portland. Second in ownership of such cars is the New Haven, with 40 units.

The road announces that almost all passenger service outside rush hours will make use of the new equipment. It estimates that operating costs will be cut about $1.7 million a year with the new cars and that they will enable retirement of 235 older coaches and 60 steamers.

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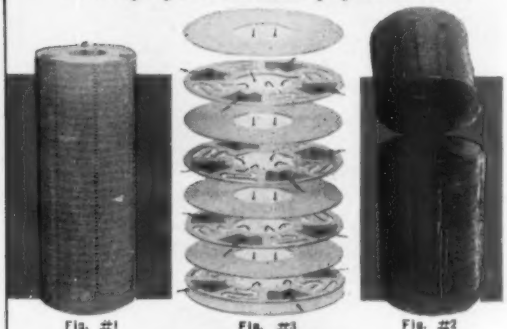


Fig. #1 Fig. #3 Fig. #2

HILCO FILTER CARTRIDGES

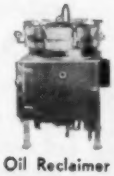
The result of much research in the field of lubricating, fuel and industrial oil filtration, the new patented HILCO Filter Cartridges meet the need for tremendous filtering area, low pressure drop and high dirt storage capacity. Above: Fig. 1 is a new cartridge; Fig. 2 is a used cartridge (note that pockets are completely filled and the outer surface covered with solids); Fig. 3 shows the flow of oil, the dark area represents dirty oil passing into the pockets while filtered oil (white area) passes into "S" shaped section.

HILCO Purification Means Complete Oil Purification . . .

You get absolute removal of sludge, acids, carbon, water and fuel dilution with a properly selected HILCO. Clean oil saves you money. Expensive maintenance is reduced, equipment shut-downs practically eliminated, lost man hours and cuts in production become a thing of the past. HILCO continuous, all electric, automatic purification keeps your oil clean and in top condition at all times. You receive the full capacity and economy of your equipment.

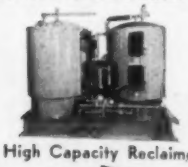
HILCO offers a wide range of oil purification units to meet every oil conditioning problem. HILCO units are manufactured in both stationary and portable models. Write us about your purification needs . . . recommendations are given with no obligation. Let HILCO put its 25 years of experience in oil purification to work for you.

THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM



Oil Reclaimer

Purifier Re-Refiner



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new products

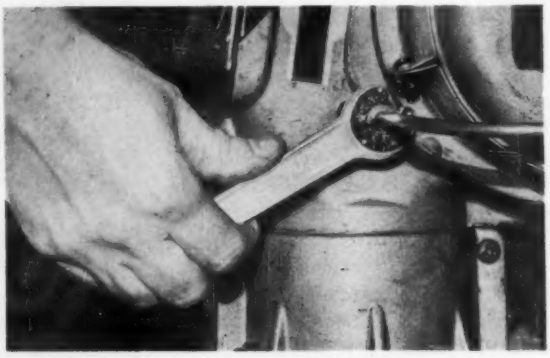
Tachometer

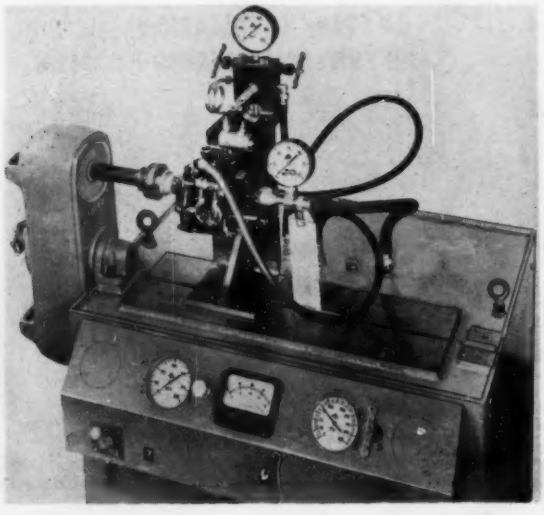
Boulin Instrument Corp. has announced a new, lightweight tachometer called the "Visutac" which measures rotary or vibratory speeds of machines or objects from a distance of from 3 to 50 ft and more. The device operates by a spring-wound mechanism which stops motion by a stroboscopic principle. It is a simple, accurate, mechanical instrument only slightly larger than a baseball and weighing only 11 oz.

Its applications include measurement of the speed of rotating objects having no accessible shaft ends such as drills, mixers, and governors. It is also used for objects such as fans, blowers, pumps, propellers, and turbines. Other uses include measurement of speed of oscillating and vibrating objects such as pneumatic hammers, valves, tappets, shuttle and vibratory screens. The tachometer is available in two basic ranges: 500 to 800 and 1000 to 16,000 rpm-vpm.

Roller Ratchet Wrench

Designed for faster, more efficient operation, the Cam-Loc is a new, one-piece, open-end ratchet wrench. It is a "temper-saving" wrench for mechanics working in awkward, hard-to-get-at places. It will fit over badly burred or heavily painted nuts due to the spring expansion allowed behind the steel rollers. According to the TKF Co., the wrench will not mar chrome fittings and its roller principle offers a tighter grip and equalized torque. It is available in nine sizes ranging from 3/8 in to 1 in.





Calibrating Stand for "PT" Pumps

An injection pump calibrating stand designed specifically for testing the Cummins PT pump has been introduced by the Bacharach Industrial Instrument Co. The stand is equipped with a 3-hp motor, variable-speed drive to simulate all pump speeds from 150 to 4000 rpm, motor-driven fuel supply pump, and a full complement of instruments for measuring rpm, pump strokes, fuel oil temperatures, and pressures. Fuel oil heating equipment is available optionally.

The stand comes with a complete set of accessories comprising mounting bracket, drive coupling, delivery lines, measuring bracket, etc., for testing the PT pump in accordance with the manufacturer's recommendations.

According to Bacharach, designing the stand for this specific application has resulted in a price substantially lower than that of the "Universal" stand.

AMOT SAFETY CONTROL

AMOT Model 1476-47 automatically shuts down engine on high water temperature or low lube oil pressure. Features are:

1. No capillary tube and bulb used.
2. Uses well known AMOT element.
3. Several temperature sensing units can be used with one control unit.
4. Will operate an air whistle.
5. Will operate a diaphragm gas valve for large gas engine shut down.
6. Will operate as a diesel fuel shut off valve.
7. Available with 2" direct connected gas valve.

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Get maximum efficiency
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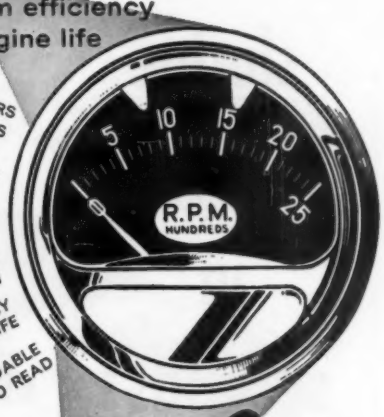

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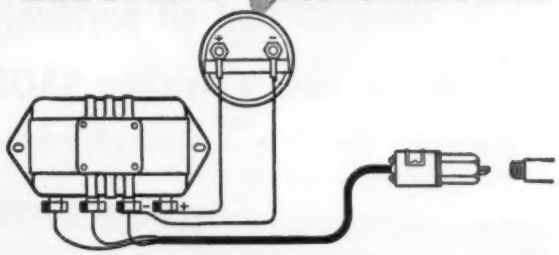

Now, New Sun Mechanical Drive Electric Tachometer for diesel engines gives consistent, more accurate RPM readings for greater diesel efficiency and economy!

Operation is simple and foolproof. The new Sun Power Units are available for standard S.A.E. drive ratios—and S.A.E. mechanical drive outlets. Troublesome, long drive shafts are eliminated. The Sun Transmitter Unit attaches to any S.A.E. mechanical drive outlet where electrical impulses are picked up and transmitted to the Power Unit and then relayed to the "Tach" head in terms of RPM.

YOU GET GREATER ECONOMY . . . HIGHEST ACCURACY—with SUN! "Tach" Head has illuminated dial with adjustable arrows to indicate safe, economical RPM range! Jeweled D'Arsonval movement, Alnico magnet and rugged double bridge construction gives accuracy to 2% of full scale AT ALL ENGINE SPEEDS!

CLIP THE COUPON—MAIL TODAY! Complete information will be sent immediately.

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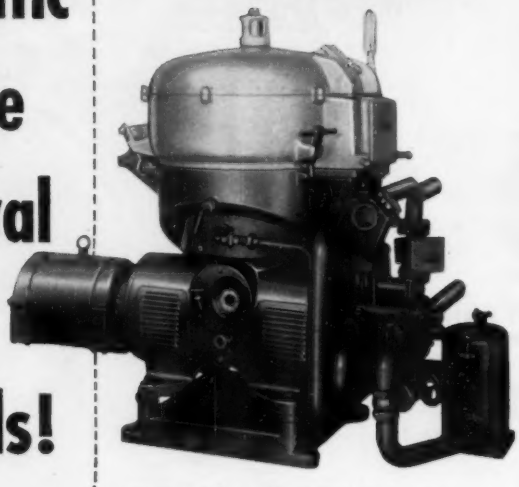

Westfalia Model SAOG-4016 Marine Type De-Sludger (self cleaning oil separator) with hinged, vapor-tight hood, equipped with built-on double gear pump, strainer, flow indicator, inspection-sample station.

Residual fuel-oil purification with the new Westfalia SAOG-4016

In purifying residual oils for use as diesel or turbine fuel, separators with self-cleaning bowls are superior to all other types of continuous centrifuges.

Westfalia Automatic De-Sludgers are the best because :

- **Fully automatic operation — saves manpower**
- **Highest capacity and separating power — cleaner, drier fuel**
- **Superior bowl design — foolproof sludge discharge — uninterrupted service**
- **One-piece de-sludging cylinder — no valve mechanism fouling — solids pass freely — no nozzle plugging**
- **Bowl cover top locking ring — no sludge leakage**
- **Stainless steel construction in a compact, sturdy design**
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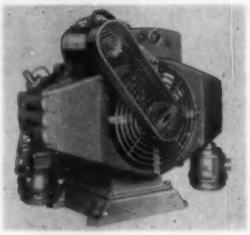


Small Air-Cooled Diesel

Formerly manufactured as the prime mover for its 5000-w generating plant, the DRP diesel is now being offered as a separate item by D. W. Onan & Sons, Inc. It is a 4-cycle air-cooled solid-injection engine giving 15 hp at 2300 rpm.

Of opposed 2-cyl design, it has a 3½-in bore, 3½-in stroke, and a 67.3-cu in displacement. Compression ratio is 17.3:1 and the unit weighs 516 lb. Included as standard equipment are a 12-v battery charging generator and 12-v electric starter. Other standards include a throttle lever template, timing gauge, and instruction manual. Optional accessories are electric glow plugs and intake preheaters, muffler, fuel tank, and crankshaft extension.

Lining for Corroded Tanks

Large water storage tanks, cooler basins, etc., that are rusting away on the inside may be restored to perfect operating condition with a new cement preparation, according to Pocono Fabricators, Inc. Called C-17 Pre-Krete, it is claimed not to shrink or crack or be subject to high temperature failures. In addition, it is stated to be easy to apply and to set in a few hours under normal temperature and atmospheric conditions.

To apply, the interior of the tank is first dried and usually cleaned with a wire brush. The preparation is then mixed with water to a paste consistency. A trowel is used to apply the paste to a ½-in thickness. After the lining has set, a small amount of water is placed in the tank and the manhole closed. In such a moisture-laden atmosphere, it will cure in 24 hr. The linings are said to meet all government MIL standards.

new products

Torque-Limiting Wrenches

Addition of 10 Model F Proto torque wrenches has been announced by Plomb Tool Co. They are "super-precision" units with a fixed head bearing pin, improved roller block, side adjusting seal, and handle end seal. Calibrated to plus or minus 3% accuracy, plus a maximum of 2 lb, they conform with military specifications.

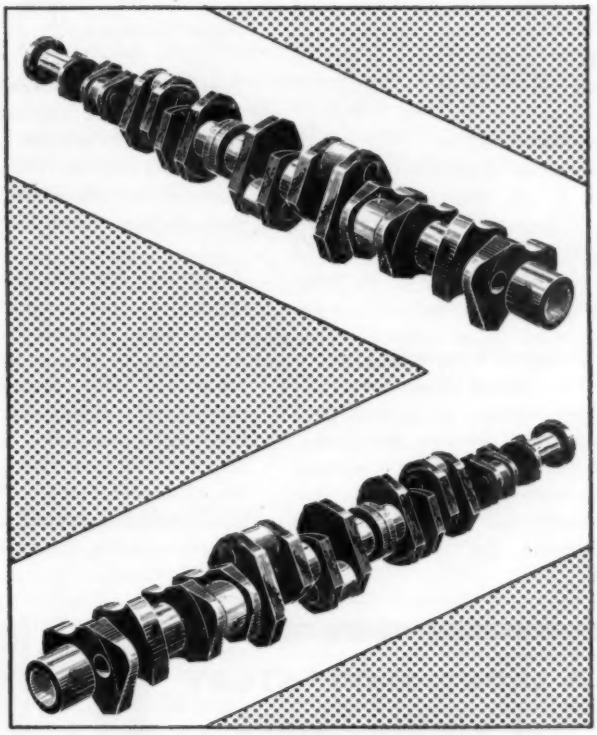
Like the 12 regular models of the company, these new tools use a torque-limiting principle instead of dials or other indicating devices. When the desired torque set on the micrometer-type handle is reached, the wrench releases automatically, signals the user with a reflex action, and resets itself. The line includes models with ¼-, ⅜-, ½-, and ¾-in drives with plain and ratchet heads, and with capacities from 5 to 4800 in-lb and 100 to 500 ft-lb.

40-Ton Dump Truck

Engineered for off-highway hauling jobs in open pit mining and earth or rock moving is the new spring-mounted 803, latest offering of Kenworth Motor Truck Corp. Body capacity struck is 24 cu yd; heaped load is 28 cu yd. It has a GVW of 150,000 lb, and measures 12 ft across the front hubs.

It is powered by a single diesel varying between 300 and 500 hp dependent on grade of loaded haul. A 2-axle, single-axle-drive truck, its turning radius is 36½ ft with a turning angle of 30 deg. Front axle capacity is 50,000 lb, rear 100,000 lb. Together they weigh 14,026 lb. Control is by power steering. It has torque converter-type transmission. Tires are 18 by 33, about 6 ft in diam.

CRANKSHAFTS



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new literature

Protective Closures
which may also be used for sealing or masking of parts, are listed along with available sizes, specifications, and types in literature from Ray A. Scharer & Co.

Safety Controls
for every type of internal combustion engine is the subject of the latest catalog from Viking Instruments, Inc. All instruments are pictured and fully detailed, including necessary ordering information.

The Complete Excavator Line
offered by Marion Power Shovel Co. has been written up in a 40-page bulletin which features action photos of each basic machine type along with condensed specifications. One page is devoted to the 60-yd 5760 coal stripper, the "world's largest" shovel.

24 Cost-Cutting Ideas
with industrial trucks are contained in a broadside released by Elwell-Parker Electric Co.

Surface Finish Measuring
instruments and accessories which can be used to measure bores, clearances, and to identify metals, are illustrated and described in a folder available from Brush Electronics Co.

Preventive Maintenance
check lists and color coded wall charts, made available by Caterpillar Tractor Co. in the past for owners of DW20 and DW21 tractors, have received such widespread acceptance that similar material is now obtainable for DW9 and DW15 tractors; No. 15 scrapers and No. 21 cable control; No. 20 scrapers and No. 27 cable control; and, No. 21 scrapers and No. 27 cable control.

12 Maintenance Tips
for getting more life out of conveyor belts are contained in a 23-in by 33-in wall chart offered by Hewitt-Robins, Inc. It deals with storage, correct design of loading chutes, use of automatic switches, etc., and also lists different types recommended for various applications.

Aluminum Alloy Selection
is made easy with a slide rule prepared by Howard Foundry Co. The selector shows specifications for every major aluminum alloy and condition used in both the sand mold and permanent mold casting processes, condensing information contained in many pages of engineering manuals.

New Stub Tap Standards
just developed by the National Screw Machine Products Assn., plus details on its own stub taps manufactured to these standards, are featured in a 4-page folder issued by Besly-Welles Corp. These taps have shorter shanks and in the larger taps, reduced thread length.

A SHORT, SHORT STORY of VIKING PUMPS

and the handling of Petroleum Products

Pump	Petroleum Products	Pressure	Capacity	Application	Service
Positive, Smooth, Self-Priming VIKING Rotary Pumps. 750 Cataloged models. Thousands of Special Models	LP-Gas Aviation Fuel Naphtha Gasoline Fuel Oil Diesel Fuel Hydraulic Oil Bunker C Lube Oil Grease Asphalt	100 PSI General Purpose 200 PSI Heavy Duty 500 PSI Hydraulic Oil	½ to 1050 G.P.M.	Transferring Fueling Lubricating Cooling Spraying Filtering Coating Loading & Unloading	Bulk Station Transporting Processing Field Gathering Refining Pipe Line Coating Heating Power Diesel Engines Dry Cleaning Road Distributors Hydraulic Machinery Barge & Tanker

More Viking Pumps are used for these services than any other rotary pump. For latest information, ask for catalog 55S d today.

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps

See our catalog in Sweets

THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP

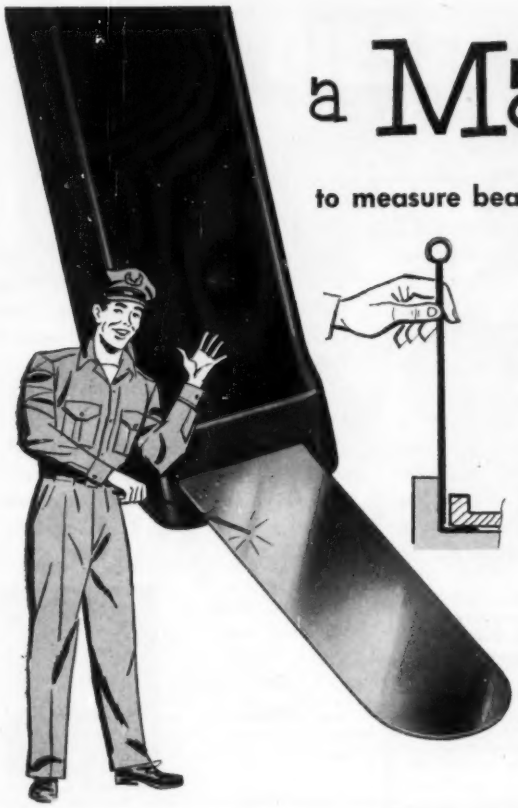
Engine **PROTECTION** WITH *Synchro-Start* **SAFETY ALARMS**

Synchro-Start SAFETY ALARM SETS automatically warn with visual and audible signals as soon as such conditions as low oil pressure, low air pressure and overheating, etc. occur.

Three switches are provided—control "on-off"—test—audible alarm cut-off. For added protection these alarm sets may be equipped with automatic shut-down in case signals are not heeded.

Further information upon request.

SYNCHRO-START PRODUCTS
INCORPORATED
8151 N. RIDGEWAY AVE. • SKOKIE, ILL.



a Magic steel shim

to measure bearing clearances without dismantling engine

Now measure Diesel engine bearing clearances in a matter of minutes with the Kjaer Bearing Feeler Gauge. No down time is needed, because this shim, of different sizes, can be inserted between journal and bearing. By inserting rod between crank web and bearing, the shim turns a 90 degree corner!

The gauge is a flat sheath, inside which is a sliding steel rod. The shim, attached to the rod, can be pushed out of the end of the sheath into the bearing clearance space. A set of Kjaer feeler Gauges can measure the clearance ranging from 2 to *10* thousandths of an inch. It is a valuable tool for every Diesel maintenance engineer.

Write for more information on Kjaer Bearing Feeler Gauges. It'll save you lots of time later!

Burmeister & Wain American Corp.
17 Battery Place New York 4, N. Y.

new literature

Electric Pre-Heaters
are one of the answers to winter maintenance probelms. With cold weather not too far distant, Kim Hotstart Mfg. Co. urges you to write now for literature describing its cold-weather starting device which plugs into any electrical outlet.

Type S and SS Diesels
for marine, stationary, and portable applications, with horsepowers ranging from 375 to 1000, are comprehensively reviewed in a 20-page bulletin offered by Ingersoll-Rand.

Flexible Metal Hose
corrugated, and of annular and helical construction, is described in Bulletin No. 20-E available from Atlantic Metal Hose Co., Inc. Steel and bronze hose with and without wire braid, couplings, and assemblies are detailed along with complete engineering data such as bending radii, bursting pressures, and weights.

Putting Air Pressure to Work
is the theme of a new publication by Ross Operating Valve Co. Called the "Ross enginAir", it will be published bi-monthly. First edition contains feature application stories, and a discussion of pneumatic fundamentals.

"Cummins Who's Who"
identifies a 40-page directory of original equipment manufacturers who offer Cummins diesels as standard or optional power. Divided into five sections: buses; construction and mining equipment; on-and off-highway trucks; industrial equipment; and logging equipment; it gives each manufacturer's address plus a listing of his equipment and the corresponding diesel used for power.

Pipeline Protection
with its "Scotch" brand of products is illustrated by application photos in a 16-page booklet from Minnesota Mining and Mfg. Co. Complete physical and electrical insulation properties for each product are included.

O-Rings Are Not Always Round
They can be made with straight sides of varying lengths with selective radii at the corners. Others can be triangular, compound, or in any variation. United Aircraft Products, Inc. has issued a 16-page engineering data brochure describing the uses of its various shapes of O-rings, both standard and self-energized, for static sealing applications.

Speed Sensitive Switches
and governors are covered in the latest literature release of Synchro-Start Products, Inc. Dimension drawings of the 1-, 2-, and 3-switch governors are given along with mounting instructions and explanations of various takeoffs and connectors.

Winter's Coming
which means icy runways, Revere Chemical Co. warns, and has issued literature describing its new ice melter, said to have 30 times the thawing capacity of salt. Contents include application hints and a full listing of product features.

organizational news

Sales Activities
of the AiResearch Industrial Div., Garrett Corp., are now under the management of Robert B. Butler. A veteran of 20 years with the Oliver Corp., he most recently headed sales engineering for one of its divisions.

Promotion as Chief Engineer
of industrial processes at The De Laval Separator Co. has been won by Frank E. Sullivan. He has been with the company since 1950.

Frank E. Sullivan

Three Executive Appointments
have been announced by Baldwin-Lima-Hamilton Corp. Robert B. Murray, Jr., assistant to the B-L-H president since resigning his post as Undersecretary of Commerce, has been elected a vice president and board member. James M. White is new vice president of manufacturing, vacating a similar post at ACF Industries. Col. John R. Martin has taken assignment as vice president in charge of electronics and instrumentation operations.

Morse Chain's Detroit Plant
has a new vice president and plant manager, J. Nall Candler. He has been associated with various divisions of the parent Borg-Warner Co. since 1940.

Roots-Connersville Blower
a division of Dresser Industries, has placed D. R. Fulton as manager of its Detroit district. He transfers from Chicago where he has represented Roots since 1949.

Latest Addition to Michiana
Products Corp. is C. Don Hicks, placed as vice president of its Michigan City, Ind. operations. He was formerly associated with Eaton Mfg. Co.

C. Don Hicks

For POSITIVE LUBRICATION
It Pays to Specify
TUTHILL PUMPS
For dependable lubrication of diesel engines and power units, Tuthill offers a complete line of positive displacement pumps, designed for lubricating and scavenging. Included are automatic reversing pumps and stripped models for built-in applications.
Write for the Tuthill Pump Guide listing all Tuthill Pumps for lubricating requirements. Send specifications for quotation.
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PUMPS FOR THE PURPOSE
TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
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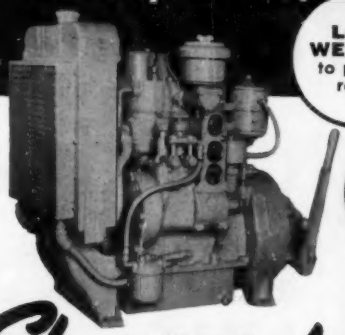
STOP THAT NOISE!
Tame your roaring ~~lions~~ lines with
BURGESS-MANNING SNUBBERS
They are individually designed, on thoroughly proved principles, to effectively correct any intake or exhaust noise caused by the flow of air, steam, or other gases. Stop that noise — profit through better neighbor and employee relations — eliminate costly oral errors — avoid compensation claims.
WHAM WHAM WHAM
Tell us your noise problem and let us recommend—no obligation.
BURGESS-MANNING COMPANY
Sound Engineering 751 East Park Avenue, Libertyville, Illinois
Dallas, Texas

NEW DIESEL
to replace gasoline engines on any 20 h.p. Job



LOW WEIGHT to power ratio

LOW COST compared to other diesels

COMPACT for portability

Sheppard

MODEL 17 - 20 H.P. DIESEL

removes the big factors which barred Diesel power from many uses. Compact in size, relatively low in weight, the Model 17 fits into the same space as any gasoline engine of equal rating. Mass produced, the Model 17 is comparable in price, too. Available as a complete power package including transmission, torque converter, generator or any other special equipment needed.

Sheppard Diesels • Hanover, Pa.

FREE FOLDER gives complete details

DEALERS Write for special Sheppard Model 17 dealer plan. No stocking required.

KIENE®

MODEL K-120

universal peak firing and compression pressure indicator

Adaptors for most models U.S.A. engines. Others made to order at reasonable prices.

The Model K-120 is the only maximum pressure indicator that can be used as a compression tester on small, high-speed engines and as a firing pressure indicator on engines having indicator valves. Patented Kiene diaphragm type check valve of stainless steel has no springs or piston, no complicated adjustments, temperature corrections or pressure loss. Bleeder valve permits release of indicator pressure for repeat readings. This instrument gives true pressure readings with an uncompensated gage.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

United Specialties Co.

has installed W. W. Lowther as vice president in charge of engineering and industrial sales. Prior to affiliating with the company in 1953, Mr. Lowther served for many years in the air cleaner industry.

C-B Has a New President

in the person of Lawrence F. Williams, taking over from Gordon Lefebvre who recently resigned for health reasons. The board of Cooper-Bessemer also gave James E. Brown the duties of secretary as a replacement for Mr. Williams, in addition to his other post as treasurer.

Lawrence F. Williams

Upped to Manager

of Worthington Corp.'s Gas Transmission Section in the Engine Sales Div., is Howard C. Barten. With the company since 1934, he was most recently assistant to the manager in the same division.

Howard C. Barten

Angus J. O'Brien

Latest Change at Gar Wood

Industries, Inc., involves the promotion of Angus J. O'Brien to the newly created post of vice president and director of engineering and manufacturing. He fills the gap left by retirement of George D. Shaeffer as engineering vice president.

Devereaux Martin

is the new vice president and director of engineering for Viking Instruments Inc. He'll direct development and research on the company's line of electronic devices and controls.

A New Jersey Office

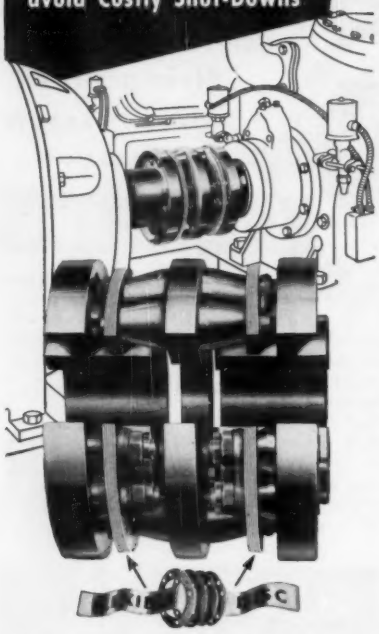
has been opened by the Tocco Div. of Ohio Crankshaft Co. to serve the NYC-NJ area. R. N. Cummer is in charge at 255 N. Arlington Av., E. Orange, NJ.

10 Years of Industrial Sales

is the background of John H. Allen, newly appointed industrial distributor sales manager at The Weatherhead Co. He was most recently with Blackhawk Mfg. Co.

John H. Allen

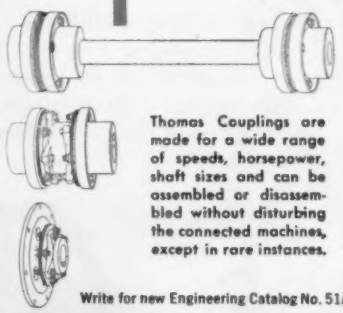
Specify THOMAS ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

Service Section

(Continued from Page 76)

form measurements (0.002) is less than the maximum of 0.003 allowed. The 0.691 measurement is above the minimum (0.690) distance between top of pin bore and platform. Carrier can be re-used only if same pin is re-used.

Example No. 2:

When using new pin:	
Carrier height	5.994
Top of pin bore to platform—	
One side	0.698
Opposite side	0.698
Pin bore to platform out of parallel	0.000

In this case, the carrier height of 5.994 indicates 0.003 wear on platform so 0.003 can be subtracted from the 0.700 limit, resulting in 0.697. There is no out of parallel condition and the 0.698 measurement is 0.001 above the low limit for carrier pin bore wear when using a new pin.

In addition to the new limits listed above, the following clearance limits, between piston and carrier, are affected:

1. Clearance — top pilot piston to carrier	New 0.003-0.007
	*Max. 0.014
2. Clearance—bottom pilot piston to carrier	New 0.003-0.007
	*Max. 0.014

*Formerly 0.012

Cleaning Procedure

Trunnion Carrier and Pin

Present experience indicates that maximum service can be obtained with a minimum expenditure of cleaning effort if the following points are adhered to:

1. Piston pin and carrier to be washed in a high flash point petroleum solvent (Stoddard Solvent 105°F flash point or equal). At no time should these parts be washed in a caustic or alkaline water solution.
2. Trunnion pin bore must be protected against rusting at all times.
3. No abrasive material of any kind should be used in carrier pin bore or on piston pin.
4. Oil grooves in piston pin should be cleaned using a wooden stick pointed to fit the grooves.

NEW LUBER-FINER INDUSTRIAL MODELS ANNOUNCED

Luber-finer

MODELS 272-C & 363-C FOR MOBILE STATIONARY & MARINE ENGINES

With up to 3 & 4 Gal. Crankcase Capacities

NOTE: All Luber-finer Models may be used on engines larger than recommended; however, the Pack life will be proportionately shorter.

CHECK ALL THESE EXCLUSIVE LUBER-FINER FEATURES

- SINGLE BOLT CLOSURE — Ingeniously designed Clamping Ring utilizes Single Bolt Closure for quick, easy Pack Replacement.
- POSITIVE SEALING GASKET — Long-lasting "O" ring type gasket assures leak-proof lid closure at all operating pressures.
- POSITIVE PACK SEAL — An outstanding feature that eliminates the possibility of oil ever by-passing the Luber-finer pack.
- DUAL SAFETY VALVES — Prevents oil drain-back, assuring exact crankcase oil level reading at all times, stops oil from circulating through unit if lines are reversed or if the Luber-finer Unit is otherwise improperly installed.

Luber-finer Units are Standard and Optional Equipment on America's Leading Diesel Trucks, Tractors and Stationary Engines

AND DON'T FORGET! For Luber-finer's Engineered Protection — Be Sure There is a Genuine LUBER-FINER PACK INSIDE!

Only a Luber-finer Unit plus a Genuine Luber-finer Pack can give you the Exclusive Patented Filtering Process that has made Luber-finer the Standard of the Industry since 1936!

For Complete Information Write Dept. 71

LUBER-FINER, INC.
2514 S. Grand Ave., Los Angeles 7

THE BEST KNOWN GUIDE TO

Diesel Design . . .
Maintenance . . .
Operating Data

THE DIESEL ENGINEERING HANDBOOK

Now in its brand *new*, 835 page, 9th Edition, the DIESEL ENGINEERING HANDBOOK is read by 55,000 top men in all industries building, servicing, or operating Diesels—Construction . . . Trucking . . . Stationary Installations . . . Marine Use . . . Railroading.

More than 900 separate Diesel topics are reviewed. Its 30 chapters analyze such vital Diesel subjects as:

- *Fuel Injection Systems*
- *Cooling Systems*
- *Fuel Oil*
- *Diesel Lubrication*
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- *Pistons & Rings*
- *Crankshafts & Bearings*
- *Supercharging*
- *Starting Systems*
- *Engine Air Systems*
- *Speed Governors*
- *Diesels By Make & Type*
- *High-Speed Diesels*
- *Marine Dieselization*
- *Dual-Fuel Engines*
- *Diesel Engine Specifications* —12,000 *Facts On* 1100 *Diesel Makes & Models*

Here's what the Automotive Engine Rebuilders Association Bulletin has to say of the DIESEL ENGINEERING HANDBOOK:

"The most complete and best known Diesel reference book . . . just the thing for the Diesel man, whether a beginner or veteran, who wants to have at hand, when he needs it, vital information and data."

Order *now*, and put it to work for YOU. You'll want to consult it every day—to keep abreast of the most efficient maintenance procedures . . . to know the construction details of every Diesel . . . to insure reduced equipment "down-time".

GUARANTEE—*If within 10 days of the time you receive the* DIESEL ENGINEERING HANDBOOK, *you find it will not help you, return it, and we'll gladly issue a full refund*

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192 Lexington Ave., New York 16, N. Y.

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HB 10/5

LOW COST INSURANCE FOR DIESEL FUEL INJECTION SYSTEMS

with AMERICAN BOSCH "FSA" final stage fuel oil filter

Give your Diesel fuel injection equipment positive protection against damage caused by minute dust and abrasive particles. Install an American Bosch "FSA" Final Stage Fuel Oil Filter. It costs just a few dollars, yet contains an improved water-resistant filtering material that traps all particles that get through primary and secondary filters. The sealed construction is tamperproof . . . installation on any Diesel is quick, easy, inexpensive.

You'll find that the American Bosch "FSA" Filter will pay for itself many times over by lowering maintenance and overhaul costs. For the full story, contact your nearest American Bosch fuel injection agency or write to American Bosch, Springfield 7, Massachusetts.

2931

AMERICAN BOSCH
Division of
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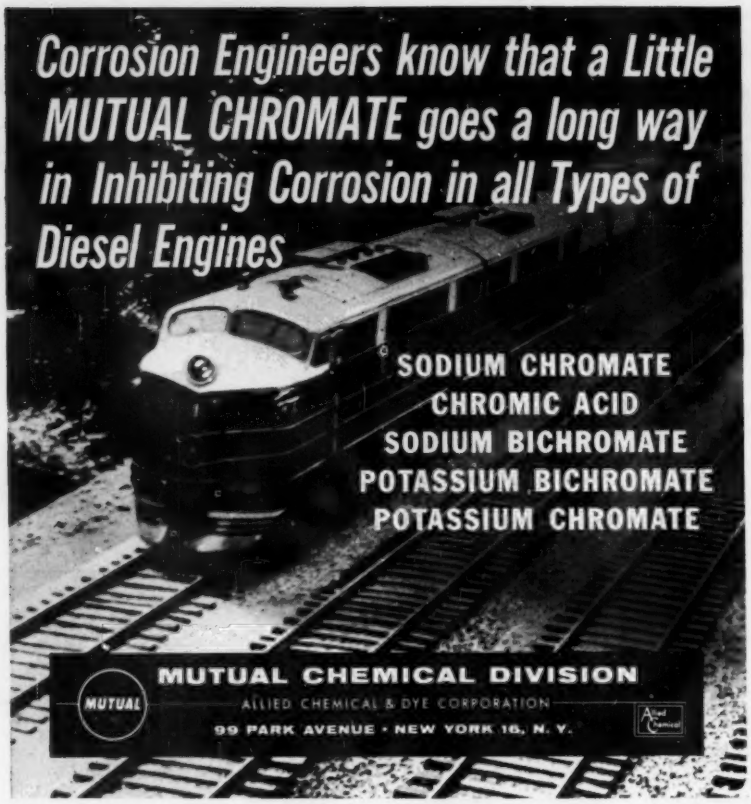
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Aircooled and Watercooled
2½ to 48 hp diesels for every industrial and marine need

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news of our industry

Foresees Higher RR Outlays

Railroads will have to spend at least $20 billion for improvements in the next 10 years if they are to meet transportation needs, Pennsylvania Railroad president James H. Symes stated. This represents twice the amount spent in the last 10 years.

He based the forecast on estimates that rail hauling in 1965 will be more than 850 billion ton mile or 53% more than the 1954 total, indicating 55% participation by railroads in the overall hauling job in the U. S. This percentage would be a reversal in the downward trend of rail participation in all transportation during the last decade.

Mr. Symes spoke at a luncheon at General Motor's recent Powerama. He declared that GM's newly developed lightweight train will be "a serious challenge" to the problem of railroad passenger losses. Both the Pennsylvania and New York Central have ordered prototypes of the new train.

He didn't hold out much promise for long-haul passenger business over 1000 mi, because of the time element involved. However, "the potential mass travel . . . between metropolitan areas for shorter distances with comfortable sit-up trains . . . with much lower capital investment per seat, plus the lower maintenance cost, will enable the railroads to operate such trains at fares that will tap that enormous potential travel market and produce a profit."

185 Diesels to Southern Pacific

Placement of orders for 185 diesel locomotives at a cost of $34 million has been made by Southern Pacific Co. Most of them will be assigned to mainline freight service and will allow retirement of more than 170 steamers of various types.

Currently the road's diesels are handling 86% of freight, 87% of passenger, and 81% of yard switching service. The new diesel orders were placed with Electro-Motive Div. of General Motors, Alco Products, Inc., and Fairbanks, Morse & Co. All new units are scheduled to be in operation by May.

news of our industry

JT-6 Express

To make quick deliveries from Seattle, Wash. to Baxter Springs, Kans., Kenworth Motor Truck Co. designed this special trailer which carries three of its cab-beside-engine tractors. The three are part of a fleet of 200 diesel tractors now being delivered to Yellow Transit Freight Lines, Inc.

Powered by the new 175-hp Model JT-6 Cummins Turbodiesels, the new tractors are replacing 250 gasoline-powered tractors. The conventional Kenworth carrier has a 200-hp Model NHB-600 Cummins diesel as motive power.

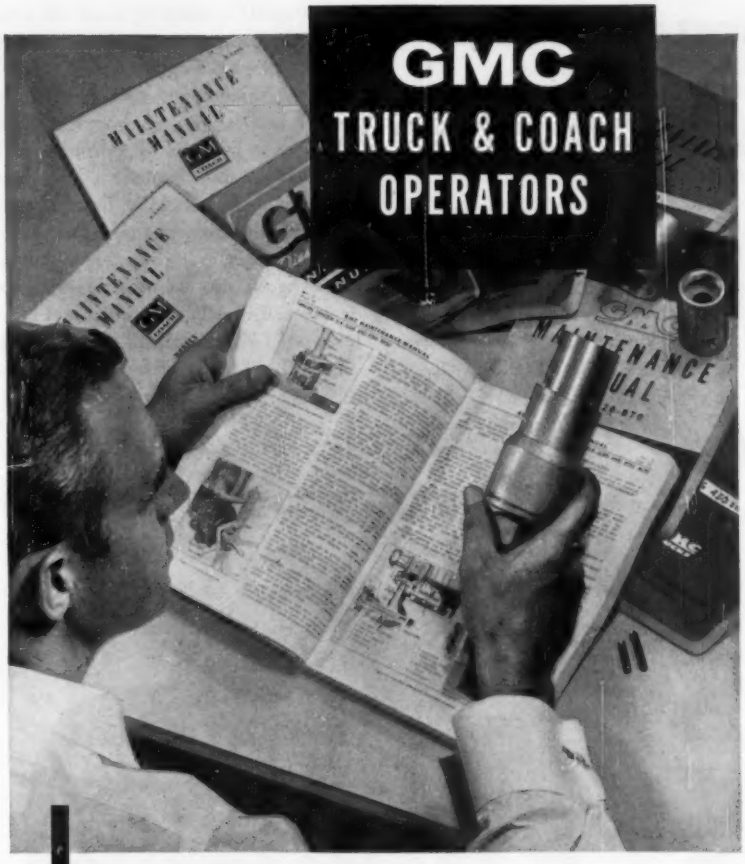
PIE Places New Truck Orders

Twenty XD-30 dromedary tractors and 25 tank truck and trailer units are among the new equipment included in a $3.75 million order placed by Pacific Intermountain Express Co. The XD-30 was designed and built by PIE this year on an experimental basis and this is the first order placed after exhaustive road tests. More payload was disclosed as the basic reason for the dromedary design.

The XD-30 has two sets of steered wheels mounted on tandem axles, air springs in place of conventional steel springs, and a pancake Cummins diesel mounted underneath the cargo box.

The 25 tank truck and trailer units are part of a modernization program for PIE's recently acquired System Tank Lines. The trucks will be cab-over-engine models, the engines being turbocharged Cummins diesels.

Kenworth Motor Truck Corp. received the order for 10 of the XD-30 trucks and 15 of the tanker trucks. The other 10 tanker power units and 10 XD-30s will be built by Peterbilt Motors Co.



YOUR MAINTENANCE MANUALS SHOW WHY YOU NEED
KENT-MOORE *RATE-MAKER*
SPECIAL SERVICE TOOLS!

Next time you refer to your GMC Maintenance Manual, notice how often it specifies the use of a "J-number" tool . . . like the J 4863 shown above, for example, which is used in servicing heavy duty axles.

That "J", you know, is the prefix used to designate Kent-Moore "Rate-Maker" Special Service Tools. And there are many good reasons why their use is recommended. For you see, Kent-Moore Tools are developed in cooperation with your vehicle manufacturer to perform many important maintenance operations for which no adequate standard tools exist. They save time, prevent parts damage, improve service efficiency, And, combined, they give you the means of duplicating factory-assembled conditions in the field. So whether you service your own GMC's or have them serviced by others, make sure the job's done right . . . with Kent-Moore Special Service Tools!

UPON REQUEST—Complete information on the entire line of Kent-Moore "Rate-Maker" Special Tools for servicing GMC Trucks & Coaches according to factory-recommended procedures. There's no cost, no obligation . . . so send for it today!

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KENT-MOORE ORGANIZATION, INC.
5-105 General Motors Building • Detroit 2, Michigan
Engineers and Manufacturers of Special Automotive Service Tools and Equipment

news of our industry

NY Central Orders 61 Diesels

To keep pace with its growing volume of business, the New York Central Railroad has placed an order for 61 diesel locomotives costing $9,601,000. According to Alfred E. Perlman, president, the road's volume is currently running about 20% heavier than last year.

Electro-Motive Div., General Motors Corp., will build all the locomotives. The order includes 45 general-purpose units of 1750-hp for road and switching service. Of these, 21 will be equipped with steam heat generators for passenger service. The remaining 16 units of the order will be 900-hp yard switchers. Delivery is scheduled to begin in October and end at the finish of the year.

"By streamlining our organization and procedures and through increased utilization of equipment now owned," Mr. Perlman stated, "we have already achieved a 90% dieselization of our freight and passenger operations. With the acquisition of these 61 additional units, we will add another 93,150 hp to our present total of approximately 2,425,000."

Carrier Expands with Diesels

S & W Motor Lines, Inc. announces that it has embarked on an expansion and modernization program in excess of $1 million. First order under the new project includes a new fleet of 25 turbocharged diesel tractors, representing about one-third of its present over-the-road equipment.

In need of lightweight diesel tractors that would pull 35-ft high volume trailers, the carrier placed the order with International Harvester Co. for tilt-cab 205's, equipped with 175-hp JT-6-B Cummins Turbodiesels and Strick trailers. The units are expected to average 85,000 miles per year to haul 30,000-lb payloads over mountain roads while maintaining fast schedules.

Looking toward complete standardization of equipment, the president of the Greenboro, N. C. line made announcement of an additional order for Cummins-powered units from International-Harvester, type and number undisclosed.

A-C to Up Earthmover Output

A $1.8 million expansion program for the Cedar Rapids, Iowa works of Allis-Chalmers Mfg. Co. has been announced. Motor scrapers and wagons are made in that area. Enlargement is expected to increase productive capacity by 50%.

Class I Railroads Redefined

The Interstate Commerce Commission announces that Class I railroads will now only include those with annual gross revenues of at least $3 million. Formerly, the dividing line was $1 million.

This new definition reduces the number of Class I railroads from 126 to 113. An estimated 338 carriers will be in Class II beginning the first of the year. The revision also terminates Class III carriers, who had below $100,000 revenues, placing them in Class II.

Good Temperature Control is essential

. . . TO HEAVY DUTY POWER!

Vernatherm thermostats assure *correct* operating temperature.

Solid charged and precision built, these thermostats have proved themselves in the field over and over again. They have proved that rough duty and rigid limitations need not mean frequent thermostat replacement!

Detroit Controls Corporation pioneered Vernatherm thermostats to meet the needs of modern pressurized cooling systems. They have solved a great number of tough problems on Diesel, heavy-duty gasoline and jet engines. Vernatherm controls might be the solution to a situation in *your* engines .

Call on DETROIT sales engineers for test data and actual field results . . . or write for Bulletin 213 which gives basic data on Vernatherm controls and their function in modern engine design.

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news of our industry

What is a Rebuilt Engine?

This question was recently raised by the National Better Business Bureau, occasioned by current advertising offering rebuilt engines for various makes of cars. Queried by the Bureau, the Automotive Engine Rebuilders Assn. furnished recommendations it had established a few years ago. Since it concerns the diesel field as well, it is reprinted for review purposes as follows:

"Engine to be disassembled, thoroughly cleaned, cylinder block and parts carefully inspected. Rebuilding operation:

"Refinish cylinders; Install new expansion parts; Regrind crankshaft; Install new main bearings; Align bore main bearings; Install new camshaft bearings; Recondition valve seat, renew if necessary; Recondition or replace defective connecting rods; Install new pistons, pins, rings; Install new valves, springs, guides; Install new connecting rod bearings; Install new timing gears or chain; Install new oil pump or recondition old; Recondition cylinder head; Install new gaskets throughout.

"All parts to be original equipment or equal, and all assembly clearances to be according to manufacturer's specifications."

Management Aids

The Small Business Administration, Washington 25, D. C., announces that it is cooperating with private sources to publish a series of leaflets designed to aid the small manufacturer and distributor in running his business. Some of the technical aids include various phases of lubrication, cleaning techniques, preventive maintenance, and corrosion causes and prevention. About 105 titles have currently been covered.

Filter Calibration Testing

The Pall Filtration Companies are making available a glass bead filter calibration service for critical filtration. The method used is said to be sensitive over the range of 5 to 80 microns, with extension down to 1 micron possible if demand dictates even more critical service.

To evaluate the performance of a filter, a dilute suspension of known-particle-size distribution beads in a desired fluid is passed through the filter at about normal flow rate. A portion of the filtrate is centrifuged and the concentrated suspension examined microscopically. Filtration performance is reported as "percentage of beads passing" in given ranges. As low as .0001% of bead passing is said to be readily detected.

Combustion Short Course

Designed to aid oil personnel connected with the practical and theoretical end of the combustion processes, a special course covering fundamentals and new developments in fuel technology and combustion will be held at Oklahoma A&M College, Oct. 24 and 25. Material will include both elementary and advanced, and a question and discussion period designed to obtain answers to individual combustion problems will accompany each lecture.

when the new power is a Diesel with

S-N REDUCTION GEARS

Operating cranes, pumps, shovels, draglines and similar heavy duty equipment can be mighty expensive when they're powered with ailing, old, slow speed gasoline engines with hard-to-get parts. Just switch to a modern high speed Diesel—plus a famous S-N Reduction Gear Unit—and keep your repairs and rebuilds to a minimum. That means less down time during the working season when it really hurts! And you save as much as fifty percent in fuel costs compared to a gasoline engine. Remember, S-N Reduction Gear Units insure smooth, full power from engine to load with maximum economy. Ideal for original equipment and all types of engines from 40 H. P. units to 755 H. P. giants. Range of reduction ratios—1.5:1 to 4:1.

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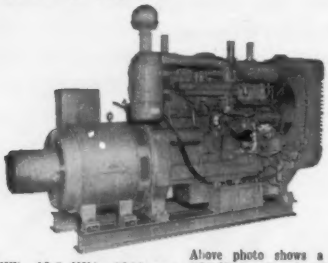
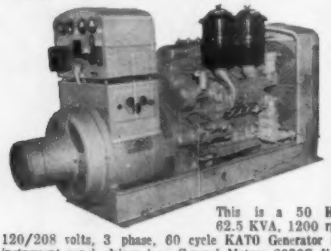
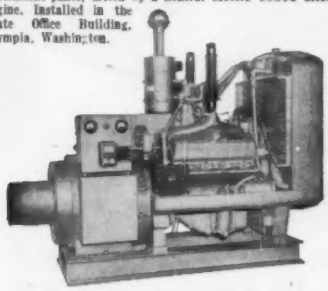


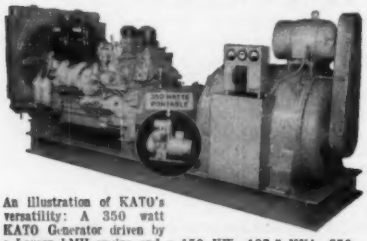
Above photo shows a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generators and instrument panel, driven by an International Model UD-18A diesel engine. Installed for the Mechanical Construction Division in Salt Lick, Kentucky.



This is a 50 KW, 62.5 KVA, 1200 rpm, 120/208 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by a General Motors 6030C diesel engine. Installed in the State Office Building, Olympia, Washington.



This pictures a 75 KW, 93.5 KVA, 1800 rpm, 240 volts, 3 phase, 60 cycle KATO Generator and instrument panel, driven by an H-540 LeRoi engine utilizing natural gas for fuel. Installed for Republic Steel Corporation of Gary, Ind.



An illustration of KATO's versatility: A 350 watt KATO Generator driven by a Lauson LMH engine and a 150 KW, 187.5 KVA, 750 rpm, 120/208 volts, 3 phase, 25 cycle KATO Generator and instrument panel—driven by a General Motors twin 6-71 diesel engine. For Duluth, Mesabi & Iron Range Railway.

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new products

Packaged Centrifugal Switches

The latest development in the Synchro-Snap line of centrifugal switches produced by Torq Engineered Products, Inc. is described as a compact speed regulation unit, separately housed, which can utilize up to three independent governors for control of multiple or inter-related circuits.

The controls can be located almost any place, vertically or horizontally, to detect or control speed on almost any device using rotary motion. It detects rotation speed alone, independent of voltage or load. Applications described include over and under speed protection on diesels and cut-out on starter motors.

Cold-Metal Solder

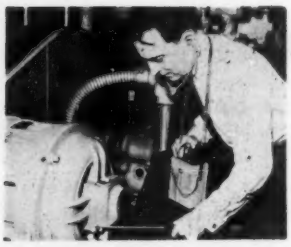
An aluminum-based compound, Lab-Metal, a moldable metal in paste form, is being marketed by Alvin Products, Inc. It is claimed to harden upon drying to form a permanent bond to metal, wood, plaster, glass, or plastic, and to offer a hard, rust-proof, water-proof, metallized surface.

No heating or mixing is required. A further claim is that temperatures as high as 350°F and as low as —40°F are withstood. Tensile strength is 650 psi; Rockwell E hardness is between 4 and 8.

New Industrial Truck Series

The KGA51 line, equipped with torque transmission, has just been introduced by Yale & Towne Mfg. Co. Built in 3000- to 8000-lb capacities, the new lift trucks have optional diesel-, gasoline-, or LPG-powered prime movers.

With the Yale torque transmission, it is claimed, transmission overheating has been eliminated by providing a large oil reservoir, running oil lines through an auxiliary radiator, and applying fins to the lines. Necessary oil pressure is supplied by an externally mounted pump, equipped with a relief valve and in an easily serviced position. Another maintenance feature provides for removal of the entire transmission unit without disassembly.



Flaw Detection By Sound

An electronic flaw detector, Auditec, for locating faults and bearing failures in motors and machinery, leaks in pipe lines, and surface flaws in materials, has been introduced by John Ould, Ltd. The unit is portable, weighs 2½ lb, and consists of a contact microphone encased in a probe handle, a 3-stage amplifier, and plug-in headphones. Visual measurement is obtainable by adding an output meter.

Powered by standard batteries, it picks up sound only by actual contact, so that airborne noises will not affect it. Various probe microphones are available to equip the instrument for specific functions.

High Pressure Hose

For use in making up hose assemblies for hydraulic and other heavy-duty applications, The Imperial Brass Mfg. Co. is offering a new line of "Hi-Duty" hose and reusable couplings which permit tightening with ordinary wrenches.

The line includes single-wire braid and double-wire braid rubber-covered hose, and single-wire braid cotton-covered hose, conforming to both SAE and JIC standards. Each of the three types is identified by markings in the body hex and is offered with a wide range of adapters.

Larger Tapping Attachment

Latest tapping attachment available from Tapmatic Corp. is the "700", with capacity from ¼ in to ½ in. It operates on the same weightless tapping principle as the smaller capacity attachments and does not require any lead pressure by operator. It has a positive torque adjustment clutch which stops the tap when it becomes dull, loaded, hits a hard spot, or bottoms in blind hole tapping.

new products

Diesel Hydraulic Starter

Allison Div. of General Motors Corp. has announced a new hydraulic starting system for diesel engines. Called the Hydrostarter, it consists of a hydraulic motor, a piston-type accumulator, an engine-driven pump, a reservoir, and a manual pump.

Specially engineered to operate in remote installations, it needs no outside energy source. After the accumulator has been loaded and sealed with an inert gas, the engine-driven pump maintains pressure and the manual pump permits emergency recharging. Temperature is also said to have little effect on starting speed.

The motor extends slightly more than 9 in from the engine flywheel housing for compact installation. It can be coupled to practically all diesel engines up to 300 hp in the same manner as a conventional electric starter. Another claim is that its high static torque—80 ft lb at 3000-psi working pressure—delivers top performance under extremely adverse conditions.

Hydraulic Lifting Dolly

Ken E-Z is the name Ken-Tool Mfg. Co. has applied to its improved dolly that makes it possible for one man to remove and replace single or dual truck wheels unassisted. The dolly features pivoted roller spindles so that the operator can produce a rocking motion to line up the wheel hub with the axle. A rear booster bar vibrates to loosen bearings for removing wheels and also for feeding brake drum into the shoe when wheels are replaced.

It removes single and dual wheels up to 12 in by 24 in and track wheels up to 48-in diam. Mounting is on sturdy free-rolling, 4-in casters.

Duel-Sensitivity Voltmeter

Associated Research, Inc. is marketing an instrument for measuring structure to soil potential in corrosion control and cathodic protection work. Called the Hayward Model 610, it consists of a special voltmeter having two different sensitivities so as to permit two readings on the same range scale when connected across any galvanic cell. No tubes or batteries are required.

Simple to use, the instrument is connected to the source of voltage, proper polarity selected, and a reading obtained. A pushbutton on the panel is then depressed and second reading is obtained. If the two readings are identical, the value read is the true open circuit voltage. If the second reading is less by not more than 5%, the difference is added to the first reading. Greater than 5% difference true open circuit voltage is calculated by formula.

The instrument weighs 2½ lb. It can also be used to measure structure to structure potential and voltage drop in the soil itself, and is also said to be suitable for conventional voltage measurements such as output voltage of rectifiers.

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How much of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?*

At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload **Preignition**
Scaled Jackets **Clogged Ports**
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Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

***Get Full information**—Quickly!* Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.

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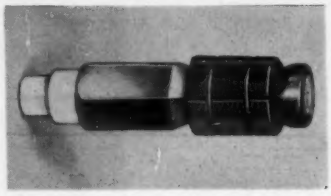
new products



Internal-Grip Pipe Wrench

Larger size Tube Tules, which remove or install pipes and tubes by gripping them from the inside, are now being offered by Double T Products Co. Complete sizes now range from ½- to 4½-in ID.

The tool has six movable knurled-surface segments on its top end which, when inserted into the pipe, are expanded by hand-turning the knurled head on the other end. These segments move up the bevel until they make inside contact. The pipe can then be moved in or out of its connection by using a wrench on the hex body of the tool.

Torque Limiting Coupling

Slip couplings, mechanical devices for controlling and fixing the maximum torque transmitted from a driving to a driven machine, have been released to the market by Techniflex Corp. Up to the limit to which they are adjusted, they act like conventional flexible couplings; beyond, a free-wheeling or slip effect is permitted between the driving and driven halves of the couplings.

Two functional properties associated with the slip effect are the ability to use the decoupling action to trip a safety or emergency switch and the ability to apply the repetitive hold and release action to supply a repetitive hammer-blow effect. This last is important in mechanisms which develop spotty wedging or fricative effects. The couplings are also claimed capable of working bi-directionally with independent torque rating for each direction if required. They are available in standard nominal ratings from 24 to 100,000 in-lb.

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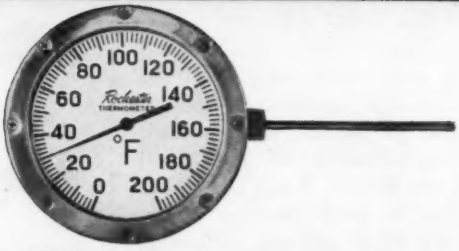

USE

Rochester Dial Thermometers

Hermetically sealed against moisture and dirt to bring you years of trouble free service.

Recalibrate the dial externally by inserting the stem in liquid of known temperature and adjusting screw attachment.

Designed to be used indoors or out, the stainless steel case is impervious to most corrosive agents.

Rochester Straight-Form Thermometers bring you the added advantage of a stem that can be mounted in any position around the dial.

For additional information contact your Rochester sales engineer or write:

Rochester Manufacturing Company, Inc.
34 Rockwood St., Rochester 10, N. Y.

DIAL THERMOMETERS GAUGES AMMETERS

new products

Bottom Dump Motor Wagon

The TW-360, a hydraulically operated bottom dump motor wagon has been added to the line of Allis-Chalmers Mfg. Co. A 280-hp diesel, providing 2100 rpm, powers the 47,000-lb unit. Forward speeds range from 3 mph in first to 20 mph in fourth gear. Reverse speed is 3.1 mph.

The motor wagon has a 22-cu yd heaped and 17-cu yd struck capacity. Overall length is 35 ft, 10½ in. Wagon portion is 12½-ft long. Engineering features include 2-speed hydraulic steering, 24-v electric system, 4-wheel air brakes, and 1-lever control to operate doors.

Chrome-Moly Alloy Welding

For welding of chromium-molybdenum alloy steels in fabrication of equipment, Metal & Thermit Corp. is offering a new arc welding system using low-hydrogen chrome-moly electrodes with special carbon content not previously available commercially. Called Murex Croloy, the electrodes come in four types for percentage of chromium in weld deposit.

Applicable to high-temperature needs, their controlled low carbon content is said to assure more ductile weldment. Other claimed features: weld cracking is almost completely eliminated; extremely high preheat temperatures are avoided; need for maintaining preheat after welding and prior to stress relieving is reduced; and in many welds, need for stress relieving is obviated. Current ranges are higher than those used for conventional electrodes of the same size. For example, a ⅛-in diam electrode requires about the same current input as a commercial rod of 5/32-in.

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Covers centrifuging, oil reclamation, all types of filters and strainers, proper oil function, durability of lubricants, oil acids, abrasives, soot, in fact it offers a refreshing review of what good lubrication should be . . . . and how to get it.

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OAKITE COMPOSITION No. 116 is applied by brush, spray or immersion. Dissolves grease, oil, sludge almost instantly.

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new products

Air-Cooled Compressor

Ingersoll-Rand Co. has added a 125-hp electric-driven air compressor to its line of air-cooled, 2-stage Type 40 stationary compressors. The new size is expected to fill the need of contractors and industries for a lightweight compressor that can be easily moved from job to job.

Features of the unit include a single-core, horizontal-flow intercooler; new shrouding; force-feed lubrication; full free-air unloading; and a new version of the I-R channel valve. Adaptable to either permanent or temporary jobs, it is claimed easily installed with a minimum of foundation, time, and labor in only 22 ft of square space. Either constant-speed control or dual control can be furnished, dual control available with either automatic or manual selection. The line has thus far included sizes of 25, 40, 50, 75, and 100 hp.

16,000-Lb Die Handling Truck

Three types of power units are optional for a new die handler developed by The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio: battery, gas-electric, or diesel-electric. Said to be the smallest capacity model of this type built to date, the truck's limit is 16,000 lb. It features hydraulic lift and push-pull members.

The truck, called Model E-12-16, has a 152-in overall length, 60-in overall width, and a 66-in long and 60-in wide platform. Platform raises from 17½-in above floor to 74 in.

Deflection Indicator

For use where any runout is critical, Allis-Chalmers Mfg. Co. announces a new deflection indicator, adaptable to any shafted machinery. Operating on a balanced bridge principle, the device consists of two inductor coil pickup units, which operate on 60-cycle, 110-v power source, and a control assembly.

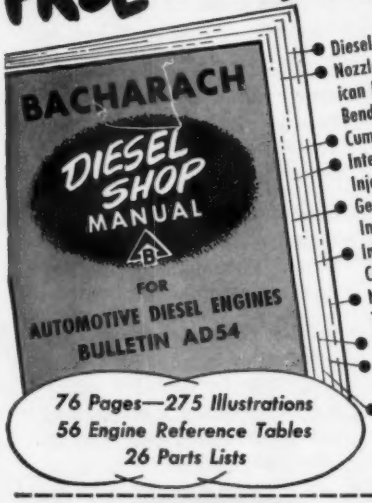
The pickup units can be mounted in almost any location where they can be fixed close to the source of possible vibration. They are fastened rigidly to some structural member. The control unit can be located at any convenient point. If a shaft deflection or vibration occurs beyond the limit setting on the device, action is such as to energize a time delay relay. If unbalance continues beyond setting of the time delay, audible warning, flashing light, or shutting down of unit occurs.

New Steam Cleaner Series

Kelite Products, Inc., 1250 N. Main St., Los Angeles 12, Cal., is manufacturing a Model K line of steam cleaners, gas- or oil-fired, with capacities up to 300 gal per hr. Super duty models go up to 3000 gal per hr.

An efficient heat exchanger raises water temperature to 100°F before the water enters the main heating circuit, accomplished by trapping waste heat and thus reducing fuel consumption. Other features are an automotive-type piston pump and a device which automatically maintains strength of cleaning solution at the desired pH. All controls are on the front of the cabinet.

FREE to Every Shop Operator



- Diesel Compression Testers
- Nozzle Testers for American Bosch, Caterpillar and Bendix Nozzles
- Cummins Injector Tester
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AD-15

OIL IS WHERE YOU FIND IT—Unfortunately, not all wells can be drilled in the sticks. Some rigs must be operated near populated areas where complete silencing is imperative if complaints from residential neighbors are to be avoided. The Kittell Residential Silencer, Series ECS, used on the demonstration rig shown above was developed for just such locations. It reduces exhaust noise to an absolute minimum, permitting round-the-clock operation. Kittell Silencers are available in various standard sizes and types, including stainless steel or ceramic coated, in any quantities. Custom models engineered to meet specific requirements. Excellent delivery. Write to Kittell Muffler & Engineering, 915 South Santa Fe Avenue, Los Angeles 21, California, for catalog. *Experienced design and application engineers needed.*

new products

Floor Jack Attachment

Any floor jack can be converted to a "hoist" in just 30 sec with its new Hy-Lift attachment, Sin Par Automotive Div. of Singer Products Co. announces. It lifts two wheels off the ground simultaneously, front, side or rear.

The attachment fastens to, and straddles, the small lift plate of a regular jack and tightens by hand screw. Made of heavy-duty ductile steel castings, its strength is said to exceed test strength of a 1- to 4-ton jack. Two detachable bumper pads are supplied, slotted to permit four different height adjustments and with tapered surfaces so that the bumper which rests upon it is aligned in its cradle automatically.

Small Power Actuator

Originally designed as an aircraft bomb shackle release, a small power actuator with a driving force of 55 lb is now being manufactured for commercial use by New Haven Clock & Watch Co. It can be actuated by an 80-watt impulse, weighs under 2 lb, and is 3¼-in long and 1 1/3-in diam.

Commercial applications are being investigated, such as remote closing of an oil pipe line when sudden pressure drop, indicating a leak, occurs, and its use as an automatic circuit breaker to cut off power systems when they become overloaded. Also being considered is its use in truck trailer brake drums, used with a linkage system to the brake shoes. If the hydraulic systems fails, driver could press a button to energize the actuator for immediate stop.

Soft Hammer Mold

General Scientific Equipment Co., 2700 W. Huntingdon Ave., Philadelphia 32, Pa., has designed a soft hammer mold claimed to offer long service and operation simplicity. Hammers produced by the mold are said to have sufficient weight to strike a hard blow, particularly in close quarters. For this reason, lead or babbitt may be used and then re-cast when they lose shape through use.

What Do You Know!

(*Answers to Questions on Page 71*)

1. Correct answer is "b". Early liner glaze may prevent the piston ring from wearing into the desired sealing contact. Ideally, liner and ring should lap together to form perfect seal. See article on Page 56 for complete discussion.

2. Correct answer is "c". First load application can be critical and must be watched for evidence of overheating, seizing, etc. See article mentioned above for details.

3. Correct answer is "b". Dynamometer capacity is a matter of torque as well as horsepower. A low-speed, big-bore engine might be rated at only 300 hp, but its torque might be more than the dynamometer could absorb. See article mentioned above.

4. "a" is correct answer although "c" says essentially the same thing. Air control is particularly helpful in reducing fuel consumption at part load operation. At the higher loads, air-gas ratios are otherwise controlled. See article on Page 64.

5. Correct answer is "b". Cylinder wear conditions will affect choice of the ring set needed to obtain sealing and oil control under the existing conditions. See article on Page 72 for a discussion.

6. Correct answer is "b". Valve springs hold the valve mechanism to the cam so that the cam controls acceleration and deceleration. Weak springs fail to maintain the contact. See the article on Page 46 for more discussion.

7. Correct answer is "a". Although there are many basic reasons for face failure, they all lead to the high temperatures that do the damage. See article mentioned above.

8. Correct answer is "b". Cracks are the result of thermal stresses imposed by localized areas of blowby. See the article mentioned above.

108
Standard Models

Honan-Crane
Multi-Cartridge Filter

Why 108 models of the same basic filter? *Because each oil filter application creates individual problems.* Scores of variable factors are involved: type of oil, additives, oil viscosity and temperature, flow rate, capacity, space available, nature and degree of contamination, type of heating required, and many more. *All* of these factors must be considered in selecting the proper filtration unit.

Honan-Crane Multi-Cartridge Filters are available in 108 models, ten sizes, and with six different types of interchangeable cartridges, each designed to do a special filtering job. Thus, no matter how unusual or difficult the application, you get a filter exactly suited to your requirements . . . and readily adaptable to *changing* requirements.

The same wide choice of models is also offered in Honan-Crane Bulk Refill and Full Flow type Oil Filters. Custom filtration performance is *standard* with Honan-Crane.

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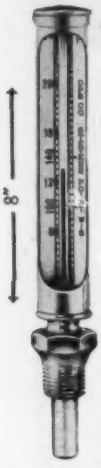

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new literature

Effective Oil Filters

are necessary for good engine life. Caterpillar Tractor Co. has prepared a booklet detailing the development of its oil filters starting at the test stand and carrying through testing in laboratory engines and in the field, to the final design.

Purified Sulfonates

which can be used in lubricating oils with no danger of stain damage to metals, may result from research reported in a 20-page booklet from the Office of Technical Services. In a series of described experiments, the stains, which seriously reduce corrosion resistance of metals, were traced to two constituents of the commercial inhibitors—water-soluble sulfonates and inorganic salts.

The extraction of these materials present difficulties since they cannot be removed with usual organic solvents. In a special process, the sulfonates were "de-oiled" and then purified by extracting the solution with toluene. Tests indicated stain reduction with this procedure.

"To Enrich Mankind"

is the title of a 25-min color motion picture designed to explain the significance of mechanical engineering in the development of our country. It emphasizes the theme of the 75th anniversary of the American Soc. of Mechanical Engineers. Loan prints are available.

Ductile Cast Iron

properties and applications have been filmed by The International Nickel Co., Inc. Running time is 15 min with sound and color. Ductility of the iron is shown by bending, twisting, impact, and tensile tests. Among illustrated uses are gears, pinions, pistons, and pneumatic couplings.

Corrosion-Protection Cost

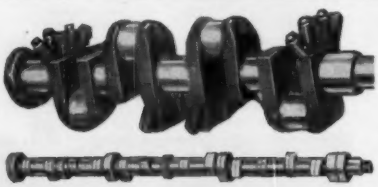
reduction is stressed by Tapecoat Co. in a brochure covering its new coal tar coating in tape form, Tapecoat-X, which is said to give double-wrap protection from single-wrap application. Lineal feet of coating necessary for different sizes of pipe are given in tabular form.

All-Silicone-Rubber Insulation

systems for electrical rotating machinery are discussed in a 4-pager release by Allis-Chalmers Mfg. Co. The recently developed Silco-Flex insulating system is described as a new approach to coil insulation for assuring longer life and more dependable operation of motors.

Advice on Storage Battery

selection, charging, handling, maintenance, inspection, and testing, for starting diesel locomotives is offered by Gould-National Batteries, Inc., Trenton 7, NJ. All these are in a collection of articles, specifications, charts, record systems, manuals, and bulletins which make up the company's plus-performance plan.



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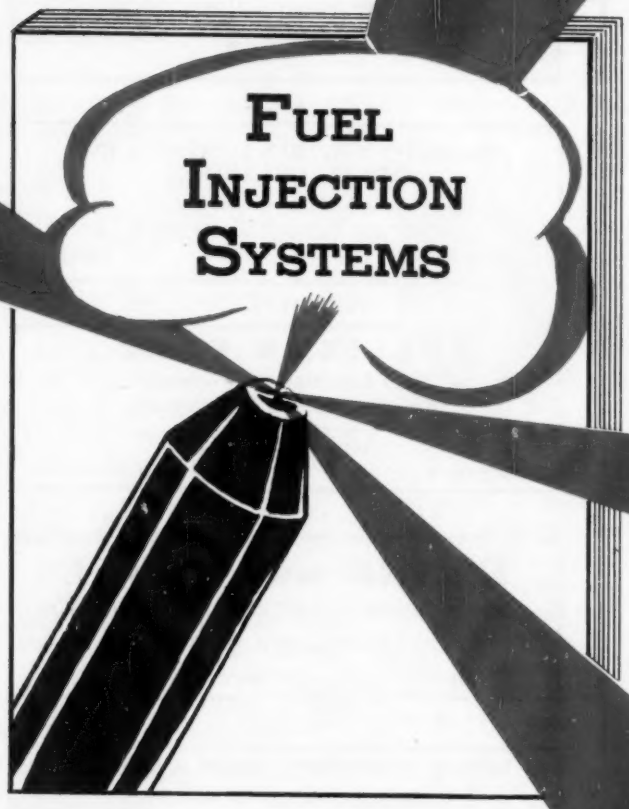

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organizational news

J. C. Mabe, Jr.

Plant Operations Managership of the Chicago Pneumatic Tool Co. has been placed in the hands of James C. Mabe, Jr. He leaves Douglas Aircraft Co., Inc., where he served for 15 years, to take the post in New York City.

Two New Vice Presidents have been appointed by Brush Electronics Co., one of the largest units of Clevite Corp. Dr. David B. Parkinson has become vice president and general engineering manager, and John H. Harris is now vice president and general works manager.

Heading the Washington Office of Enterprise Engine and Machinery Co., will be Rear Admiral John G. Johns, USN (ret.). Nineteen of his 34 years of active service was spent as a submariner, acquiring extensive knowledge of various types of diesel engines.

Admiral Johns

An Export Division has been established by Oakite Products, Inc. to handle demand from Latin America and overseas. Harry V. Kerker, who has been with Oakite since 1943, has been appointed manager.

New Posts at Houdaille-Hershey of Indiana, Inc. have been given to J. D. Weatherford and Carl F. Holland. Mr. Weatherford is now western district sales manager supervising 11 states, and Mr. Holland is southern district sales manager in charge of 13 states.

C. F. Holland

J. D. Weatherford

25 Years of Engineering experience in design and development of high-output internal combustion engines is the background of H. J. Buttner, newly appointed engineering manager for Le Roi Div., Westinghouse Air Brake Co. He's been with Continental Motor Corp., General Motors' Allison Div., and the Packard Motor Car Co.

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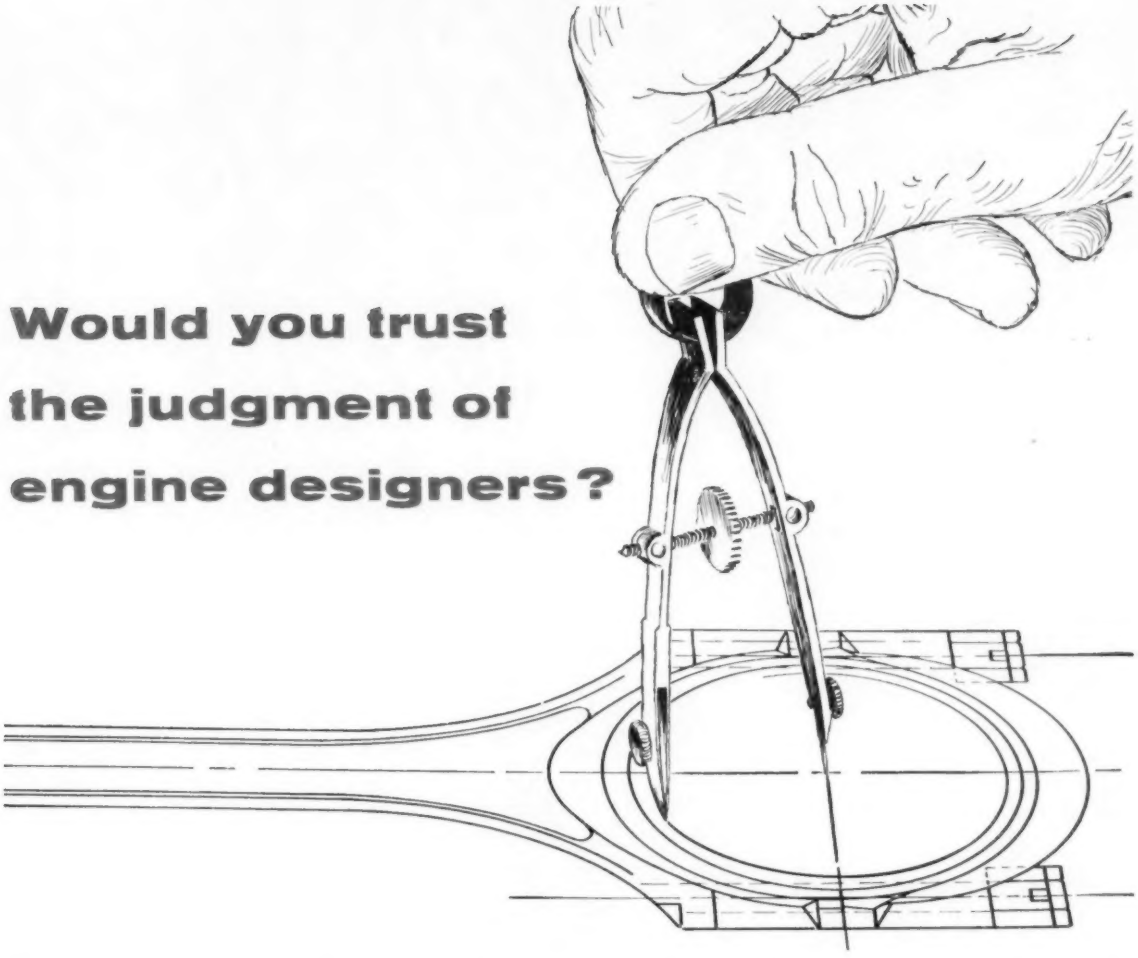

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